ENERGY OUTLOOK

FOR GHANA

Demand and Supply Outlook

2023

2023 ENERGY OUTLOOK FOR GHANA

Demand and Supply Outlook

APRIL 2023

ADDRESS

Ghana Airways Avenue
Airport Residential Area
(behind Alliance Francaise)

Private Mail Bag
Ministries Post Office
Accra – Ghana

POSTCODE

GA-037-3212

CONTACT

PHONE:
0302-813-756/7

FAX:
0302813764

WEBSITE:
www.energycom.gov.gh

EMAIL:
info@energycom.gov.gh

FOLLOW US:

EnergyCommissionGhana
EnergyCommissionGhana
EnergyCommissionGhana

EXECUTIVE SUMMARY

The Energy Commission in fulfilment of its mandate under the Energy Commission Act (Act 541, 1997) presents supply and demand forecasts for electricity, petroleum and woodfuel for the year 2023. Factors that could influence the demand and supply are also discussed.

Electricity Sub-sector

Electricity Demand

Since 2016, Ghana's system peak demand has increased at an annual rate of 8.8%. In 2022, the system's peak demand reached 3,469 MW, which was 6.9% higher than the peak demand in 2021 but 2.2% lower than the forecast for the year. Peak load, excluding export and VALCO, known as domestic load, was 3,065 MW, an increase of 5.9% from the previous year. The total quantity of electricity consumed, including losses, was 22,478 GWh, which was less than the estimated 23,579 GWh for the year. The consumption for 2022 was 4.7% higher than the 2021 consumption.

For 2023, the system peak demand is expected to be 3,673 MW, a 5.9% increase in the peak demand recorded in 2022. The projected energy consumption, including transmission losses, for 2023 is estimated to be 23,616 GWh, representing a 5.1% increase from the consumption in 2022. The losses and network usage is expected to account for 4.3% of the total projected energy consumption.

Electricity Supply

Installed generation capacity excluding embedded capacity as of December 2022 was 5,138 MW with a total dependable capacity of 4,710 MW. The installed capacity increases to 5,449.1 MW (with a dependable capacity of 4,975.2 MW) if the embedded capacity at the sub-transmission (distribution grid) level is added.

Total electricity generation in the country including embedded generation was 23,163 GWh, an increase of 4.8% over 2021 generation. Excluding embedded generation, the country's total generation in 2022 was 22,441 GWh, an increase of 5% over 2021.

In 2022, electricity made available for transmission through the National Interconnected Transmission System (NITS) was 22,478 GWh consisting of 8,192 GWh from hydro sources, 14,154 GWh from thermal and 37 GWh from import.

The electricity transmitted has witnessed a significant decrease in losses from 1,105 GWh in 2021 to 922 GWh in 2022. The losses in 2022 represent 4.1% of total electricity transmitted and a 12.9% decrease in what was projected for the year.

For 2023, a total power generation capacity (including embedded generation capacity) of 5,527.15 MW with a dependable capacity of 4,979 MW will be available to generate electricity to meet demand. The bulk (69.3%) of the dependable capacity will come from thermal sources. However, considering the planned units' maintenance and fuel supply situation, it is anticipated that up to 4,119 MW of capacity contributing to peak (4,710 MW) will be made available to meet the expected system peak demand of 3,673 MW.

The monthly demand and supply situation for 2023 gives monthly positive generation reserve margins ranging between 4% (125 MW) and 25% (805 MW). However, planned gas supply outages due to maintenance works in 2023 could lead to a generation capacity outage of up to 800 MW. This level of outage will erode all the generation capacity surplus if alternative fuel supply arrangement is not made to ensure plants are still in operation to meet demand.

Hydro and thermal plants are projected to generate 8,025 GWh (34.1%) and 15,244 GWh (64.7%) of total electricity supply in 2023 respectively. The remaining supply of 297 GWh, representing 1.3%, is expected to be met by renewable plants, including solar PV and biogas that are operating at the sub-transmission level. No power import is anticipated in 2023.

Fuel for Power Generation

Total gas supplied for electricity production in 2022 fell 6.9% short of projection, totaling 113,054 MMscf. Although no LCO was anticipated to be used in 2022, about 185,187 barrels were utilized, with larger volumes going toward the operation of the AMANDI and Cenpower power plants. KTPP also produced electricity using the majority (107,392 barrels) of the 115,201 barrels of diesel consumed by power plants. About 213,653 barrels of HFO were used to operate the AKSA plant. This volume fell short of the 548,657 barrels projected for the year due to the conversion of some units to run on natural gas.

In 2023, natural gas will remain the predominant fuel for thermal power generation. The projected total natural gas consumption for 2023 is approximately 128.5 Tbtu. Daily gas production from the Jubilee and TEN fields is restricted to 108 MMscf. It is therefore anticipated that the Sankofa fields will continue to supply up to 210 MMSCF per day to meet demand.

In August 2023, the Sankofa field is anticipated to contribute an additional 50 MMscf/day to the natural gas supply. Also, an estimated 382,619 barrels of HFO will be required by the AKSA power generating facility to run some of its units that depend solely on liquid fuel.

Transmission

Analysis of the transmission network indicates that the lowest losses are registered on the NITS in the Balanced Generation scenario. Thus, relocation of the 250 MW Ameri Power Plant from Takoradi to Kumasi to create another generation enclave aside from the East and West enclaves, will reduce transmission system losses significantly, improve voltages and aid export.

The following are transmissions challenges expected in 2023:

- Loss of 330 kV Takoradi Thermal – Anwomaso, 330 kV Anwomaso – Kintampo and 330 kV Pokuase – Volta Lines cause severe system disturbances.
- Upgrade of the 161 kV Achimota – Mallam and Achimota – Accra Central lines without significant load transfer from Kasoa, Mallam and Accra Central causes system collapse.
- With Maximum Generation from the west, the western corridor lines become heavily loaded, especially the 170 MVA Tarkwa – New Tarkwa and Tarkwa – Prestea lines.

GRIDCo is executing a number of projects aimed at improving reliability, transfer capacity, reducing losses and improving voltages. Key among them are:

- 161 kV, Achimota - Accra line reconstruction
- 161kV Achimota – Mallam line reconstruction

Petroleum Sub-sector

Crude Oil

The three commercial fields, Jubilee, TEN, and Sankofa-Gye Nyame produced a total of 51.76 million barrels of crude oil in 2022, a 6.0% decline from 2021 production. The average daily production from the three fields was low, averaging 141,808 barrels/day compared to 2021.

Production from the Jubilee fields increased from 27.34 million in 2021 to 30.52 million barrels in 2022, with average daily production also increasing from 74,858 barrels to 83,719 barrels. The average daily production from the TEN fields, on the other hand, decreased from 32,841 barrels in 2021 to 23,597 barrels in 2022, with total production also decreasing from 11.98 million barrels to 8.61 million barrels over the same period. Crude oil production from the Sankofa-Gye Nyame fields also witnessed a 19.8% reduction in the output level of 15.74 million barrels recorded in 2021.

It is worth noting that, since the onset of the global health pandemic in 2020, Ghana's crude oil production has been on a decline. It is anticipated that this trend will continue through 2023. Total crude oil production from the three fields is projected to be 46.32 million barrels, a decrease of 10.5% from 2022 levels. this will translate into an average daily production of 126,870 barrels.

Jubilee field will decrease its production from 30.52 million barrels in 2022 to 28.71 million barrels in 2023, with TEN and Sankofa fields production levels also reducing to 7.09 million and 10.52 million barrels respectively.

The average price of a barrel of Brent crude oil in 2022 was US$ 100.78, a 42.3% increase from the average price recorded in 2021. The price of US West Texas Intermediate (WTI) crude averaged $94.79 per barrel, a 30.1% increase from the average price in 2021. In 2022, the Ghana Group (representing the Ghanaian government's interest) obtained an average price of US$105.74 per barrel across all three oil-producing fields for ten liftings. The attained unit price was marginally greater than the international Brent average price of $105.09 per barrel for the same lifting dates in 2022 for all three fields. The average price paid per barrel for Jubilee crude was $101.20, TEN was $111.92 and Sankofa was $104.11.

In 2023, the US Energy Information Administration (US EIA) forecasts the average price per barrel of Brent crude oil to be $85.04. It is anticipated that the market price of crude oil from Ghana's producing fields will hover around the US$85.04 per barrel benchmark.

Prices could be much higher due to heightened market concerns regarding the possibility of oil supply disruptions, particularly in relation to the conflict between Russia and Ukraine.

Natural Gas

Total natural gas produced from domestic fields (Jubilee, TEN and SGN) decreased marginally from 256,262 MMscf in 2021 to 253,555 MMscf in 2022 due to reduced production from Jubilee and TEN fields. The average daily production of raw gas from the three fields combined in 2022 was 695 MMscf, a decrease of 1.0% over 2021 average daily production.

Jubilee production reduced from 70,527 MMscf to 68,482 MMScf whilst that of TEN also reduced from 64,130 MMscf to 55,679 MMscf between 2021 and 2022. Daily average production from the Jubilee field was 188 MMscf/day whilst that of TEN was 153 MMscf. Production of associated and non-associated gas from the Sankofa field on the other hand increased from 121,601 MMscf in 2021 to 29,395 MMscf in 2022, with average daily production increasing from 332 MMscf to 354 MMscf.

Jubilee and TEN fields exported a total of 35,881 MMscf of raw gas to the Atuabo Gas Processing Plant (AGPP) for processing into lean gas in 2022, with Jubilee contributing 86.4 of the total gas exported. Sankofa field exported 67,896 MMscf, or 95.4% of the non-associated gas produced, to the Onshore Receiving Facility (ORF) in 2022. The volume of gas exported from the field increased by 4.2% compared to the volume exported in 2021. The three fields exported a total of 107,560 MMscf of associated and non-associated gas in 2022, an increase of 8.8% over the volume exported in 2021, culminating in an increase of 8.3% in the average daily gas export between 2021 and 2022.

The total amount of lean gas supplied for power and non-power use in 2022 was 122,947 MMscf, or 354 MMscf/day, up from 332 MMscf/day in 2021. AGPP supplied 37,143 MMscf of lean gas, while the ENI ORF received 67,897 MMscf of non-associated gas. The remaining 17,908 MMscf was imported from Nigeria via WAGPCo.

In 2023, natural gas production from the three fields is expected to be 249,368 MMscf, representing a 1.7% decrease from 2022. Daily production from the three fields combined is expected to be a bit low in 2023, averaging 683 MMscf. Jubilee field is expected to increase its

production of gas from 68,482 MMscf in 2022 to 74,582 MMscf in 2023. TEN field is expected to produce 49,237 MMscf in 2023, a decline from 55,679 MMscf produced in 2022.

Sankofa production from associated and non-associated sources is expected to be 57,936 MMscf and 67,613 MMscf respectively, a decline of 0.5% and 5.0% from 2022.

In 2023, it is anticipated that the export of natural gas from Jubilee/TEN (associated) to the AGPP will decrease by 10.2%, to 35,613 MMscf. The export of Sankofa (non-associated gas) to the ENI ORF will decrease by 2.9% to 65,958 MMscf in 2023. In 2023, a total of 101,571 MMscf of associated and non-associated gas will be exported from the three fields, a 5.6% decrease over the export in 2022. In 2023, Sankofa is anticipated to maintain its supply capacity of up to 207 MMscf/day, while Jubilee and TEN are anticipated to supply a combined 110 MMscf/day. The daily imports from Nigeria are anticipated to reach 60 MMscf.

Petroleum Products

The total petroleum products produced in the country was 157 kilotonnes, down from 378 kilotonnes in 2021. The reduction may be due to the challenges of securing the necessary financing to procure crude oil for the state-owned Tema Oil Refinery (TOR). Production was from privately-owned refineries (i.e. Platon Gas Oil and Akwaaba Oil Refinery) and GNGC (LPG production).

Total petroleum products imported decreased from 4,126 kilotonnes in 2021 to 4,075 kilotonnes in 2022. Gasoil import saw an increase of 12.9%, from 1,820 kilotonnes in 2021 to 2,055 kilotonnes in 2022. Importation of Gasoline also recorded a decrease of 11.6% from 2021, with a total of 1,564 kilotonnes imported. LPG import was 263 kilotonnes in 2022, a decrease of 16.0% of the quantity imported in 2021. ATK import increased, from 188 kilotonnes in 2021 to 209 kilotonnes in 2022. For the first time in many years, 26 kilotonnes of RFO was imported in 2022.

A total of 4,214 kilotonnes of petroleum products was consumed in the country in 2022, representing a 7.3% reduction in the quantity consumed in 2021 and a 14.6% decrease in projected consumption for the year. For the first time in five years, consumption has witnessed a decline, which could be attributed to economic downtime in 2022. Gasoil, gasoline, LPG, and RFO recorded a 5%, 11.9%, 11.7% and 33% decrease in quantities consumed in 2022. However, ATK consumption witnessed an increment of 3.7%, from 202 kilotonnes in 2021 to 210 kilotonnes in 2022.

For 2023, the total petroleum products requirement is projected to be 4,778.5 kilotonnes, an increase of 13.4% over 2022 consumption.

Out of this, gasoil consumption is forecast to be about 2,236.8 kilotonnes, increasing by 12.3% over the 2022 consumption, while gasoline will be 1,817.8 kilotonnes in 2023, up by 14.0% from the 2022 consumption. LPG consumption is expected to grow by 6.5% from 305 kilotonnes in 2022 to about 324.7 kilotonnes in 2023. ATK and kerosene consumption for 2023 are expected to be 233 kilotonnes and 5.1 kilotonnes, respectively. Premix and RFO are expected to increase to 68.1 kilotonnes and 67.4 kilotonnes respectively whiles MGO is expected to increase to 25.7 kilotonnes. The requirement will largely be met by import since TOR is likely not to operate due to the financial and technical challenges it is confronted with.

Woodfuel Sub-sector

In 2022, wood extracted for use directly as fuel (firewood) was 1,692 Ktoe. The wood extracted for the production of charcoal on the other hand was 2,279 Ktoe in 2022. The production of other biomass (mainly crop residue) was 23 Ktoe in 2022.

Biomass consumption in 2022 is estimated to be 2,940 Ktoe. The residential sector has been the largest consumer of biomass in the country.

This trend is expected to continue in 2023. residential sector's consumption of biomass is expected to increase to 2,572 Ktoe, with the service and industrial sector's consumption expected to be 105 Ktoe and 324 Ktoe respectively.

The mean price for maxi bag and mini bag of charcoal in 2022 was GH¢59.78, and GH¢45.74 respectively. On average, the price per kilogram of charcoal nationwide was GH¢1.18, respectively. For 2023 charcoal price is expected to grow at the same rate as the national inflation rate for the country.

PREFACE

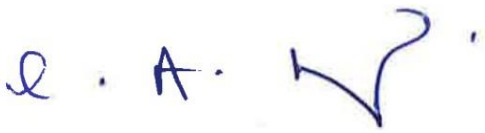
ENERGY COMMISSION is mandated to prepare, review and update periodically indicative national plans to ensure that reasonable demands for energy are met in a sustainable manner. The Commission is also mandated to secure and maintain a comprehensive database for national decision-making for the efficient development and utilisation of energy resources available to the nation. The Commission's jurisdiction includes promoting and ensuring uniform rules of practice for the production, transmission, wholesale supply, distribution and sale of electricity and natural gas.

In fulfilment of its mandates, the Commission has been preparing annual energy demand and supply outlook to provide guidelines to energy sector operators and potential investors as well as the wider business community wishing to operate in the country. The 2021 Annual Energy Outlook is to give government, industry and business, indications of the levels/quantities of electricity, liquid and gaseous fuels that would be required to be provided by the energy producers for this year.

The Energy Outlook for Ghana outlines projections for energy demand and supply for the year 2023. It provides an overview of the actual performance of the energy sector, specifically the electricity and petroleum industry performance as well as the woodfuel subsector of the preceding year (2022) comparing actuals to projections. It continues to forecast 2023 energy demand and supply.

In this report, 'Demand' is used when referring to gross fuel or energy required by a demand sector, e.g., residential, commercial, or industry. 'Supply Requirement' is supply or generation/production plus transmission/transport losses.

Your comments and suggestions are most welcome.



Ing. Oscar Amonoo-Neizer
Executive Secretary, Energy Commission

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION

AGPP	Atuabo Gas Processing Plant
ATK	Aviation Turbo Kerosene
BGS	Bui Generation Station
BPA	Bui Power Authority
BSPs	Bulk Supply Points
CEB	Communauté Electrique du Bénin
CIE	Compagnie Ivoirienne d'Électricité
COVID-19	Novel Coronavirus Disease
ECG	Electricity Company of Ghana
EIA	US Energy Information Administration
EMOP	Electricity Market Oversight Panel
ESD	Emergency Shutdown
FPSO	Floating Production Storage and Offloading
GDP	Gross Domestic Product
GNGC	Ghana National Gas Company
GNPC	Ghana National Petroleum Corporation
GRIDCo	Ghana Grid Company
GWh	Gigawatt hour
HFO	Heavy Fuel Oil
IPPs	Independent Power Producers
kg	Kilogram
km	Kilometer
Ktoe	Thousand Tonnes of Oil Equivalent
KTPP	Kpone Thermal Power Plant
kv	Kilovolt
kW	Kilowatt
LCO	Light Crude Oil
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MAF	Million Acre Feet
MGO	Marine Gas Oil
MMBtu	Million British Thermal unit
MMscf	Million Standard Cubic Feet
MVA	Megavolt Amperes
MVAr	Megavolt Ampere of Reaction Power
MW	Megawatt
MWp	Megawatts-peak

NEDCo	Northern Electricity Distribution Company
NG	Natural Gas
N-Gas	Nigeria Gas
NITS	National Interconnected Transmission System
NMS	Network Manager System
NPA	National Petroleum Authority
OCTP	Offshore Cape Three Point
OMCs	Oil Market Companies
ORF	On-shore Receiving Facility
PC	Petroleum Commission
PIAC	Public Interest and Accountability Committee
PPTC	Power Planning Technical Committee
PURC	Public Utilities Regulatory Commission
PV	Photovoltaics
RFO	Residual Fuel Oil
SAPP	Sunon-Asogli Power Plant
SAPP	Sunon Asogli Power Plant
SCADA	Supervisory Control and Data Acquisition
TAPCO	Takoradi Power Company
Tbtu	Trillion British Thermal Unit
TDS	Takoradi Distribution Station
TEN	Tweneboa, Enyenra, Ntomme
TICO	Takoradi International Company
TOR	Tema Oil Refinery
TT1PP	Tema Thermal Power Plant 1
TT2PP	Tema Thermal Power Plant 2
TTIP	Tema-Takoradi Interconnection Pipeline
TUF	Transformer Utilization Factor
US WTI	US West Texas Intermediate
VALCO	Volta Aluminium Company
VRA	Volta River Authority
WAGP	West Africa Gas Pipeline
WAGPCo	West Africa Gas Pipeline Company
WAPCO	West Africa Pipeline Company
WAPP	West African Power Pool

Chapter 1: Introduction

1.1 Introduction

Ghana's energy outlook for 2023 is expected to be influenced by a range of factors such as economic growth, inflation and energy efficiency. The country's economic growth is projected to increase (overall real GDP to grow by some 2.8 percent and non-oil real GDP to grow by 3.0 percent in 2023[1]), which will drive an increase in energy demand. Additionally, the government's efforts to expand access to electricity and promote energy efficiency are likely to impact both the demand and supply sides of the energy equation.

On the demand side, the growth of the industrial sector, particularly manufacturing and construction is likely to drive an increase in energy demand. However, the government's efforts to promote energy efficiency and the aggressiveness of the utilities (ECG & NEDCo) to reduce losses (especially commercial losses) are likely to offset some of the increases in energy demand. The 2023 Annual Energy Outlook, therefore, seeks to determine the country's ability to meet its growing energy demand while ensuring sustainable development.

In doing so, the actual performance of the energy sector, in the preceding year (2022) is assessed. Actual data was collected and compared with projections and other benchmarks. The outlook for energy demand and supply in 2023 and the challenges that the sector is expected to face are also presented.

The document is structured as follows:

- Chapter 1 is the introductory chapter that gives some background information, methodology and the report outline.
- Chapter 2 is dedicated to a review of the electricity system performance in 2022, given a comparative analysis of the projected and actual electricity demand, electricity supply and fuel supply in 2022. It also highlights major events which occurred during the year and their impact on the power system.

[1] Highlights of the 2023 Budget and Economic Policy: https://mofep.gov.gh/sites/default/files/budget statements/2023-Budget-Highlights.pdf

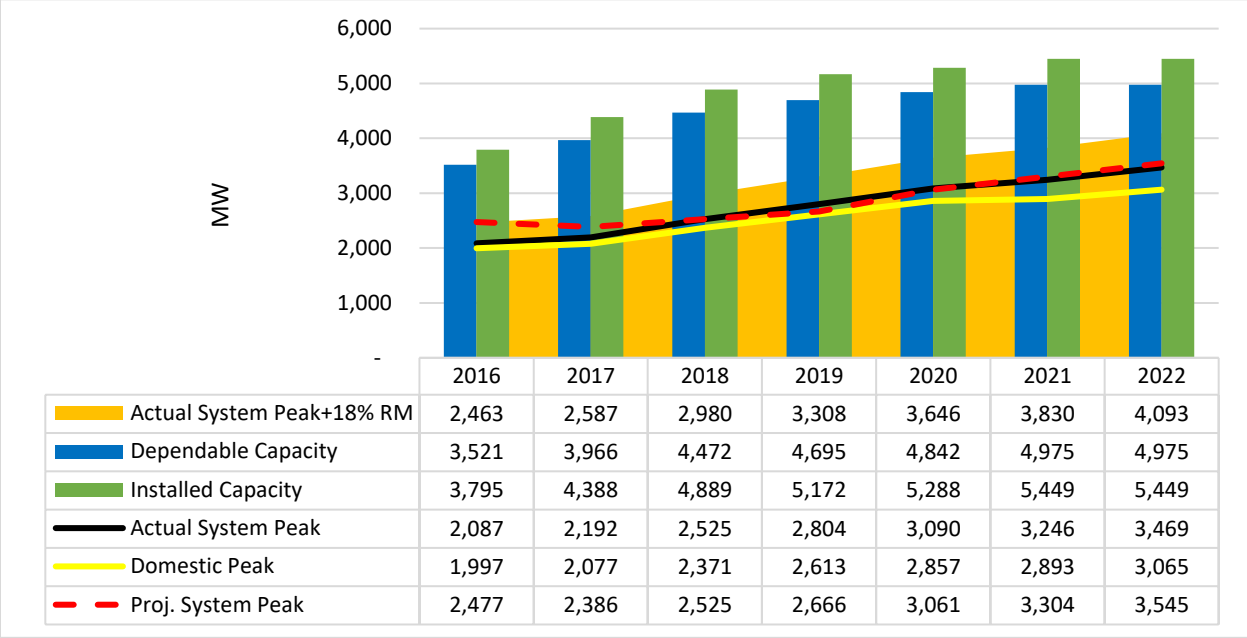
- Chapter 3 presents the outlook for electricity in 2023, giving estimates for electricity demand (both peak and energy demand), and fuel requirements to fire thermal power plants. The transmission outlook is also presented. The anticipated challenges to electricity supply for the year are also discussed in this chapter.
- Chapter 4 presents a review of the petroleum industry performance in 2022, focusing on petroleum production, import, export, consumption and prices.
- Chapter 5 presents the outlook for petroleum focusing on crude oil production and prices, natural gas export from production fields, natural gas import and petroleum products consumption.
- Chapter 6 provides some updates on the woodfuel subsector by giving estimates for woodfuel production and consumption.
- Chapter 7 provides the conclusion and outlines some recommendations for policymakers' consideration.

Chapter Two: Electricity System Performance in 2022

2.1 Electricity Demand in 2022

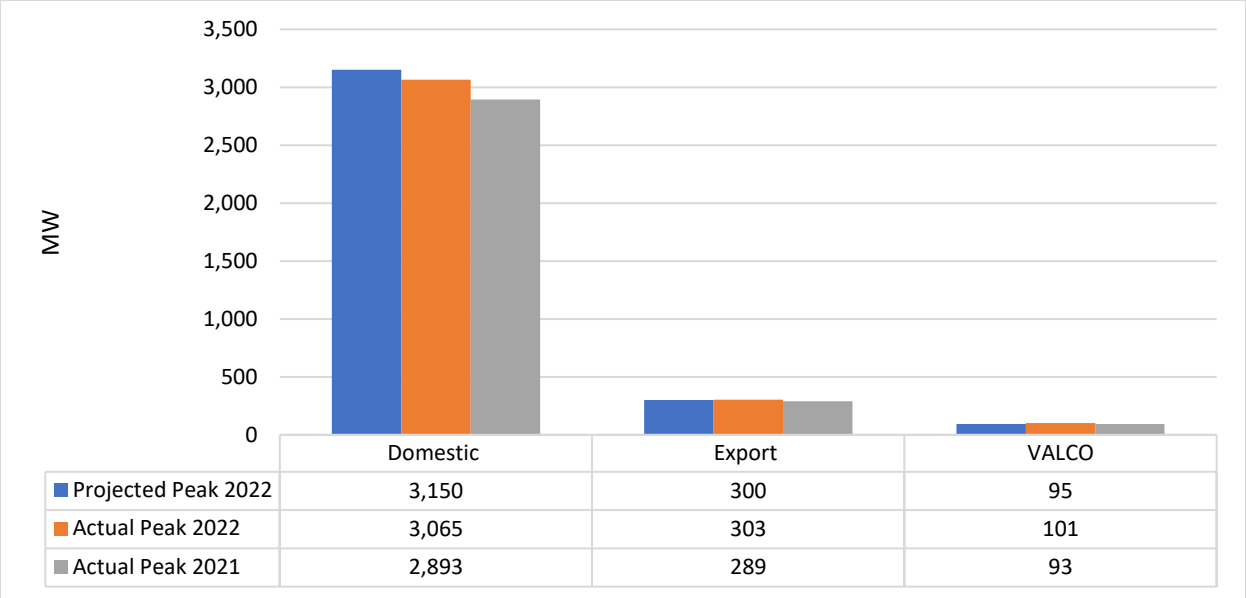
2.1.1 Peak Demand in 2022

In 2022, the system peak load (maximum coincident load) was 3,469 MW, a decrease of 2.2% compared to the anticipated 3,545 MW. The system peak load in 2022 increased by 6.9% from the peak demand of 3,246 MW recorded in 2021. System peak demand has been increasing at an annual growth rate of 8.8% as illustrated in Figure 1.



	2016	2017	2018	2019	2020	2021	2022
Actual System Peak+18% RM	2,463	2,587	2,980	3,308	3,646	3,830	4,093
Dependable Capacity	3,521	3,966	4,472	4,695	4,842	4,975	4,975
Installed Capacity	3,795	4,388	4,889	5,172	5,288	5,449	5,449
Actual System Peak	2,087	2,192	2,525	2,804	3,090	3,246	3,469
Domestic Peak	1,997	2,077	2,371	2,613	2,857	2,893	3,065
Proj. System Peak	2,477	2,386	2,525	2,666	3,061	3,304	3,545

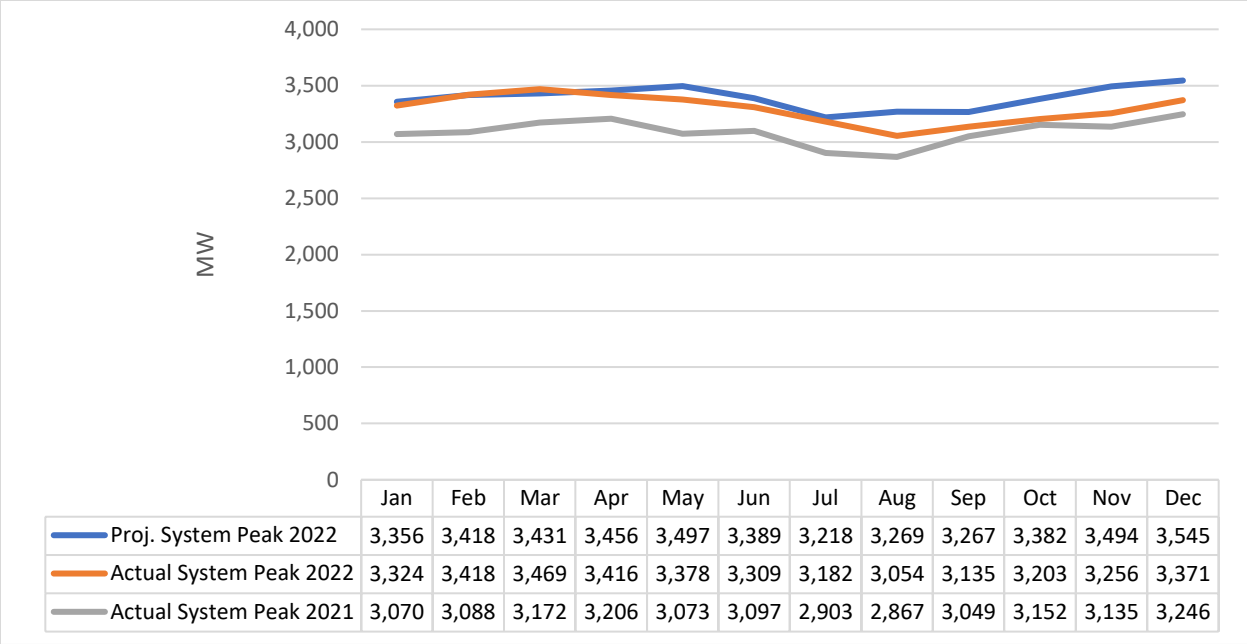
Figure 1: Trend in system peak demand from 2016-2022



	Domestic	Export	VALCO
Projected Peak 2022	3,150	300	95
Actual Peak 2022	3,065	303	101
Actual Peak 2021	2,893	289	93

Figure 2: Domestic, VALCO and Export peak demand for 2022

The domestic peak load was 3,065 MW, up by 5.9% from 2021 but a reduction of 2.7% from the forecast for 2022. Export and VALCO recorded 303 MW (up by 1.0% of the projected 300 MW) and 101 MW (6.3% increase from the projected 95 MW), respectively (Figure 2). Figure 3 compares the monthly actual and projected system peak load for 2022.



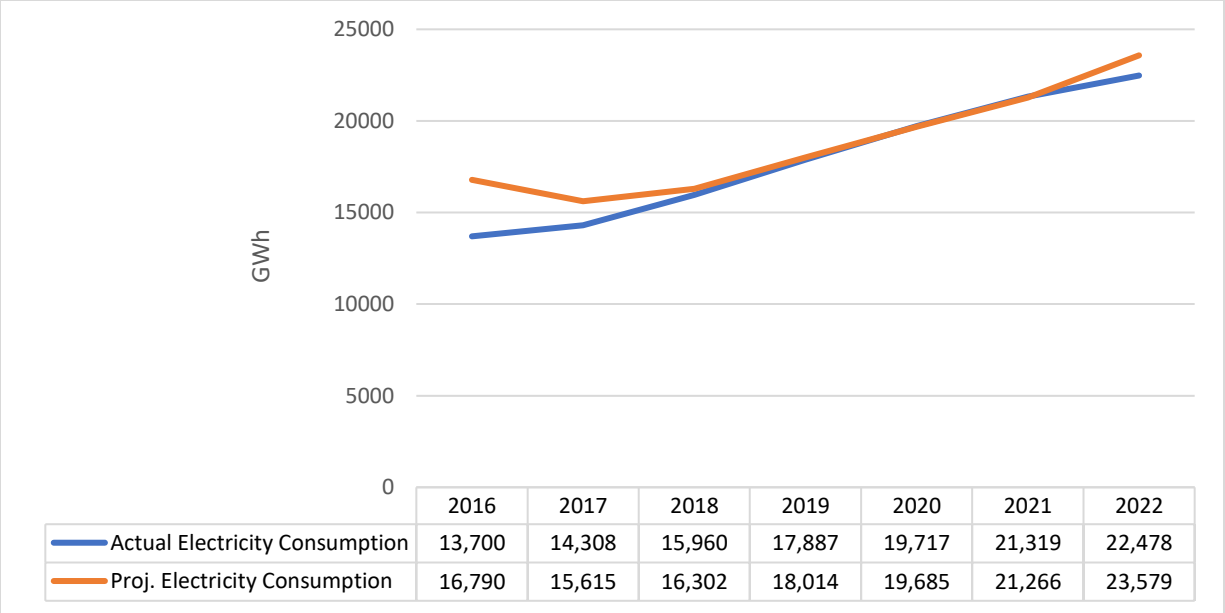
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Proj. System Peak 2022	3,356	3,418	3,431	3,456	3,497	3,389	3,218	3,269	3,267	3,382	3,494	3,545
Actual System Peak 2022	3,324	3,418	3,469	3,416	3,378	3,309	3,182	3,054	3,135	3,203	3,256	3,371
Actual System Peak 2021	3,070	3,088	3,172	3,206	3,073	3,097	2,903	2,867	3,049	3,152	3,135	3,246

Figure 3: Monthly actual and projected system peak demand for 2022

The power system began the year with a system peak demand of 3,324 MW in January, rising to 3,469 MW in March. It recorded its lowest value in August and then saw a modest rise from September to December 2022. The peak load for the year which was expected to occur in December 2022 (3,545 MW), was however recorded in March 2022 (3,469 MW).

2.1.2 Electricity Consumption in 2022

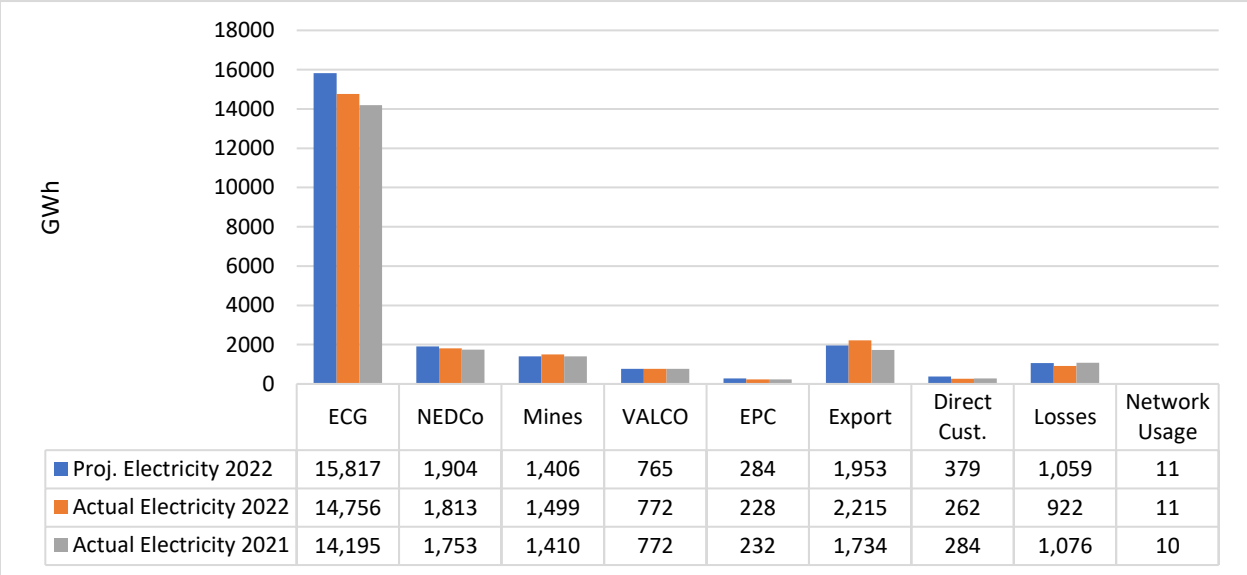
Electricity consumption by bulk customers continues to witness growth in 2022, as depicted in Figure 4. Total electricity consumed increased from 13,700 GWh in 2016 to 22,478 GWh in 2022, representing an average of 8.6% annual growth.



	2016	2017	2018	2019	2020	2021	2022
Actual Electricity Consumption	13,700	14,308	15,960	17,887	19,717	21,319	22,478
Proj. Electricity Consumption	16,790	15,615	16,302	18,014	19,685	21,266	23,579

Figure 4: Trend in electricity consumption from 2016-2022

Losses included, the total amount of electricity used in 2022 was 22,478 GWh, a 4.7% increase from 2021 (21,466 GWh). However, actual electricity consumption for 2022 was 4.7% lower than the 23,579 GWh projected for the year. The consumption by the various customer classes is shown in Figure 5.



	ECG	NEDCo	Mines	VALCO	EPC	Export	Direct Cust.	Losses	Network Usage
Proj. Electricity 2022	15,817	1,904	1,406	765	284	1,953	379	1,059	11
Actual Electricity 2022	14,756	1,813	1,499	772	228	2,215	262	922	11
Actual Electricity 2021	14,195	1,753	1,410	772	232	1,734	284	1,076	10

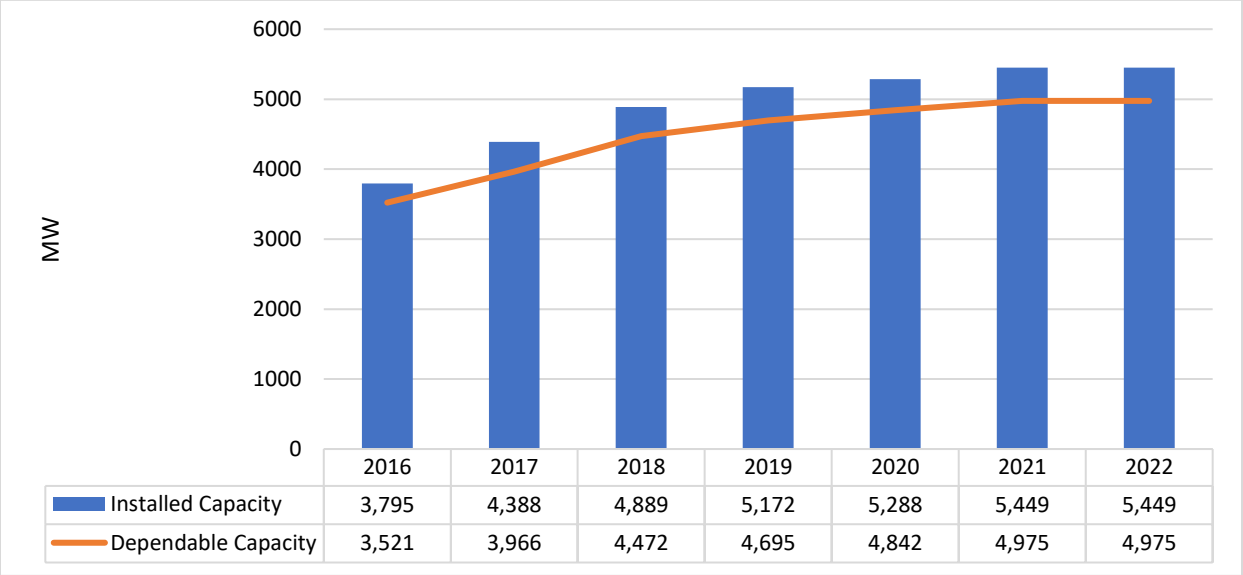
Figure 5: Electricity consumption by customer classes for 2022

The amount of electricity consumed by ECG and NEDCo in 2022 increased by 4.0% and 3.4% respectively. These figures are lower than the 15,817 GWh and 1,904 GWh projected for ECG and NEDCo respectively. Mines load increased by 6.4%, from 1,410 GWh recorded in 2021. Consumption for direct customers fell by about 7.6% in 2022, with export increasing by 27.7%.

2.2 Electricity Supply in 2022

2.2.1 Electricity Generation Capacity

Ghana's electricity generation sources are hydro, thermal (fired using natural gas, light crude oil, heavy fuel oil and diesel) and renewables (solar and biogas). Electricity generation capacity has increased over the last few years, as depicted in Figure 6.



	2016	2017	2018	2019	2020	2021	2022
Installed Capacity	3,795	4,388	4,889	5,172	5,288	5,449	5,449
Dependable Capacity	3,521	3,966	4,472	4,695	4,842	4,975	4,975

Figure 6: Installed and dependable capacity in the recent past

Total installed electricity generation capacity increased from 3,795 MW in 2016 to 5,449 MW in 2022, representing an increase of 43.6%, with dependable capacity increasing from 3,521 MW to 4,975 MW over the same period. Excluding embedded generation units, installed capacity as of the end of 2022 was 5,138 MW, with a total dependable capacity of 4,710 MW. Figure 7 shows the shares of installed and dependable capacities by generating sources. The full complement of power plants in Ghana as of the end of December 2022 is shown in Table 1.

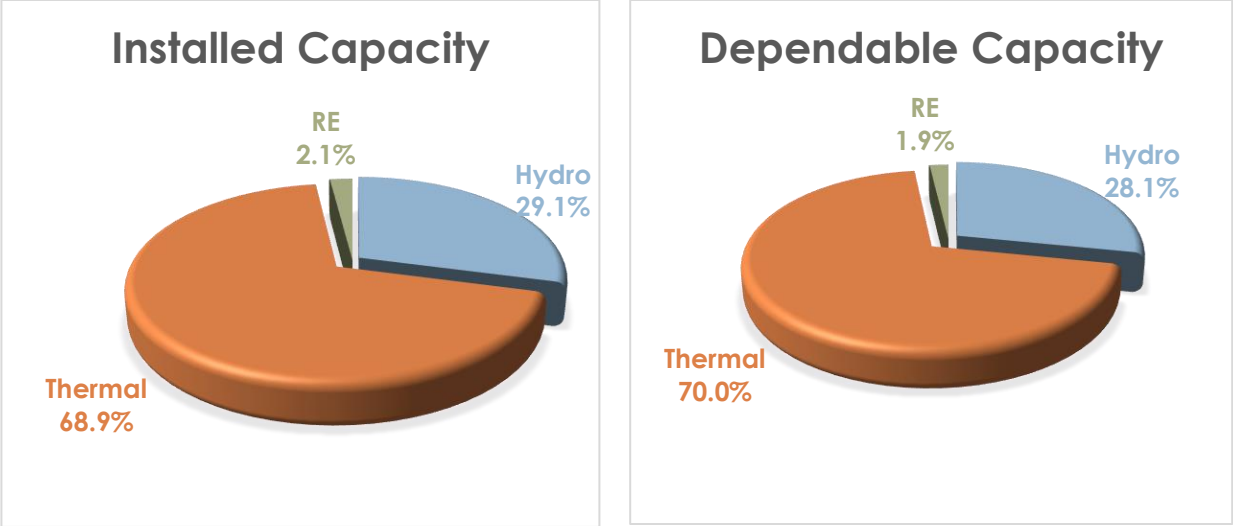


Figure 7: Shares of hydro, thermal and renewable capacity as of the end of December 2022

Table 1: Installed and dependable capacity as of the end of December 2022

Power Plant	Fuel Type	Installed Capacity (Nameplate)	Dependable Capacity
Hydro Power Plants			
Akosombo	Hydro	1,020	900
Bui	Hydro	404	360
Kpong	Hydro	160	140
	Sub-total	***1,584***	***1,400***
Thermal Power Plants			
TAPCO	Oil/NG	330	300
TICO	Oil/NG	340	320
SAPP	NG	560	520
TT1PP	Oil/NG	110	100
TT2PP	Oil/NG	87	70
CENIT	Oil/NG	110	100
KTPP	Oil	220	200
AMERI	NG	250	230
Karpower	NG/HFO	470	450
AKSA	HFO	370	350
Cenpower	Oil/Diesel	360	340
Amandi	Oil/NG	203	190
Early Power*	NG/LPG	144	140
	Sub-total	**3,554**	**3,320**
Genser	NG/LPG	155	85
Trojan	Diesel/NG	44	39.6

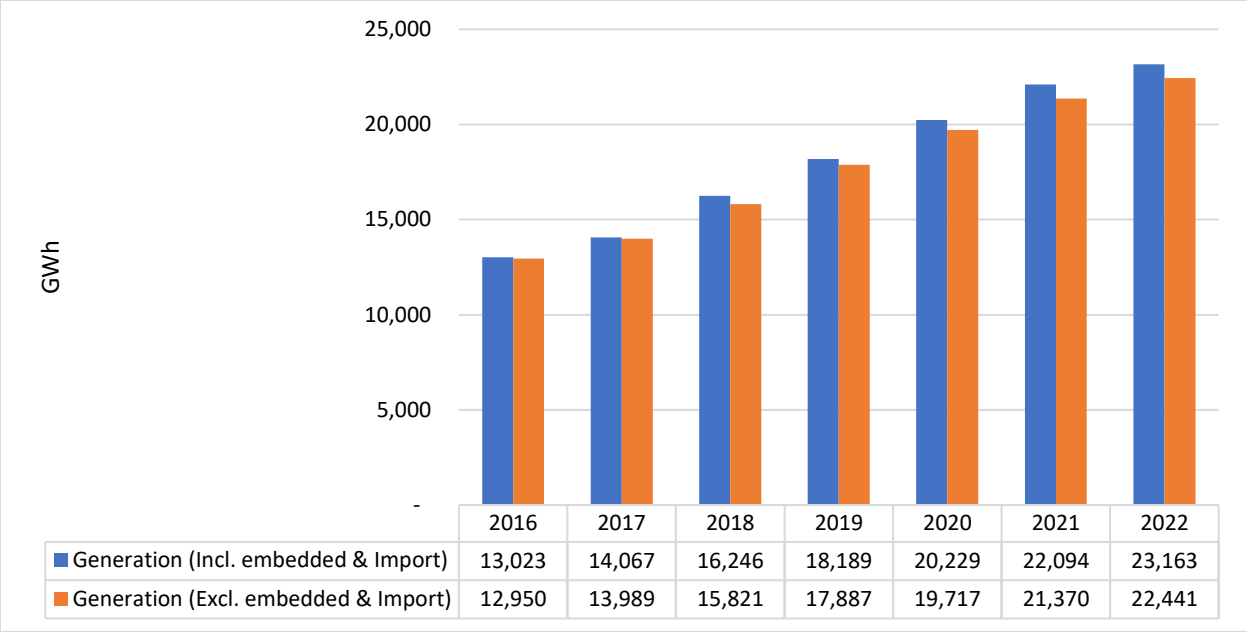
Sub–total (incl. embedded generation)		***3,753***	***3,480.6***
Renewables *(excluding large hydro)*			
VRA Solar (Navrongo)	Solar	2.5	-
Meinergy Solar	Solar	20	-
BXC Solar	Solar	20	-
VRA Solar (Lawra)	Solar	6.5	-
VRA Solar (Kaleo)	Solar	13	-
Tsatsadu Hydro	Hydro	0.045	-
Bui Solar	Solar	50	-
Safisana Biogas	Biogas	0.1	-
	Sub-total	***112.145***	**-**
Total (incl embedded gen.)		**5,449.1**	**4,880.6**
Total (excl embedded gen.)		**5,138.0**	**4,710.0**

NB: * Being converted to run on natural gas

In 2022, hydro plants contributed 29.1% of the total installed capacity, with conventional thermal plants and renewable sources contributing 68.9% and 2.1% respectively (Figure 7). Thermal plants contributed about 70% of the dependable capacity for the country in 2022.

2.2.2 Electricity Generation

In 2022, the country's total electricity generation including embedded generation and import was 23,163 GWh, a 4.8% increase over the quantity produced in 2021. Total generation at the transmission level (excluding embedded generation and import) increased by 5.0%, from 21,370 GWh recorded in 2021(Figure 9).



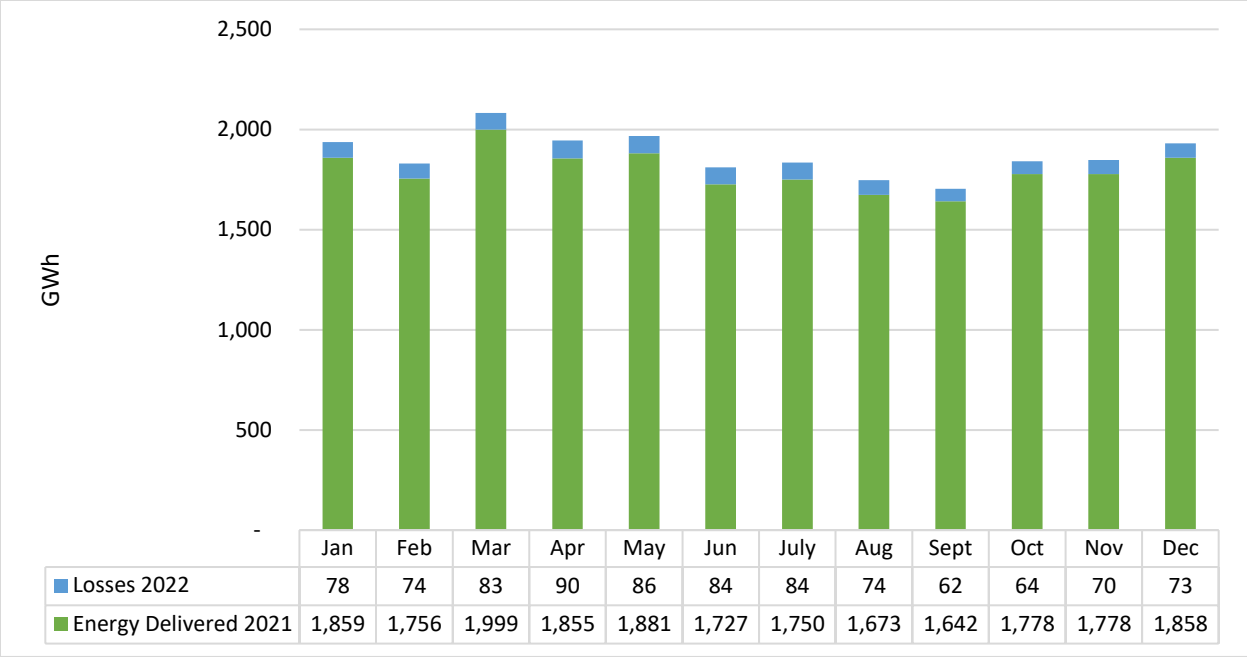
	2016	2017	2018	2019	2020	2021	2022
Generation (Incl. embedded & Import)	13,023	14,067	16,246	18,189	20,229	22,094	23,163
Generation (Excl. embedded & Import)	12,950	13,989	15,821	17,887	19,717	21,370	22,441

Figure 8: Electricity generation (2016 – 2022)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Proj. Gen. 2022	2,028	1,904	2,045	2,029	2,012	1,846	1,830	1,833	1,822	1,972	1,993	2,080
Actual Gen. 2022	1,936	1,828	2,080	1,942	1,963	1,807	1,832	1,743	1,699	1,837	1,847	1,929
Actual Gen. 2021	1,843	1,707	1,846	1,845	1,861	1,724	1,707	1,680	1,669	1,804	1,803	1,936

Figure 9: Electricity generated at the transmission level in 2022

Electricity made available for transmission through the National Interconnected Transmission System (NITS), during the year was 22,478 GWh consisting of 8,192 GWh (36.6%) from hydro sources, 14,154 GWh (63.2%) from thermal and 37 GWh (0.2%) from import (Figure 10). Total electricity generated in 2022 represents a 4.7% increase over what was generated in 2021.



	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Losses 2022	78	74	83	90	86	84	84	74	62	64	70	73
Energy Delivered 2021	1,859	1,756	1,999	1,855	1,881	1,727	1,750	1,673	1,642	1,778	1,778	1,858

Figure 10: Total electricity transmitted and transmission losses in 2022

The total electricity supplied[2] to the country for domestic consumption was 19,341 GWh, a 4.1% increase over what was supplied in 2021. Including export, the total electricity delivered was 21,556 GWh, representing a 5.9% increase over what was delivered in 2021, and a 4.3% reduction in the 22,520 GWh projected for the year.

Between 2018 and 2021, transmission losses have continued to increase, surpassing the PURC benchmark of 4.1% (Figure 11). However, in 2022 losses have witnessed a significant decrease from 1,105 GWh in 2021 to 922 GWh in 2022. The losses in 2022 represent 4.1% of total electricity transmitted through the NITS and a 12.9% decrease in the 1,059 GWh projected for the year. The decline in losses is attributed to some major system reinforcement carried out by GRIDCo in the fourth quarter of 2021 to increase power transmission capacity.

[2] Gross grid electricity plus imports, less wheeled, less exports, less transmission losses

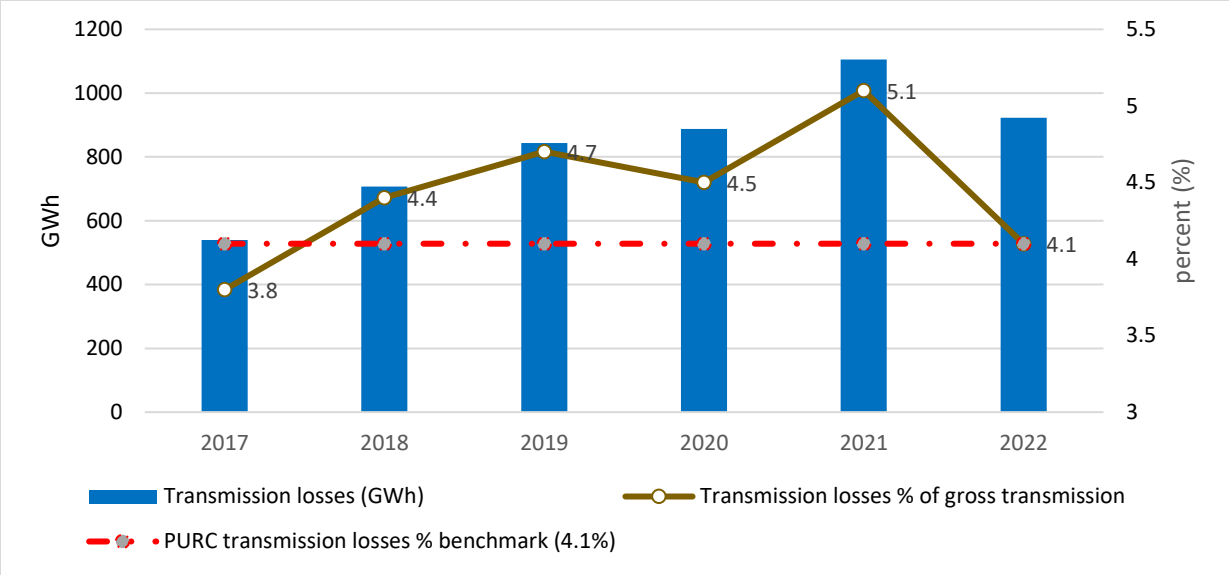


Figure 11: Trend in transmission losses in the recent past

2.2.3 Performance of Generation Sources in 2022

2.2.3.1 Hydro Generation Sources

The Volta Lake started the year 2022 at an elevation of 269.2 ft (82.0 m) and ended the year at an elevation of 272.7 ft (83.1 m). The maximum lake elevation recorded at the end of the inflow season in 2022 was 274.26 ft, an increase of 13.52 feet above the minimum elevation recorded in 2022 and approximately 34.26 feet above the minimum operating level of 240 feet. The total net inflow recorded in 2022 was 36.8 MAF, which is above the long-term average inflow of 25.21 MAF. Figure 12 shows the Akosombo reservoir trajectory for 2022 plotted against the trajectory for 2021.

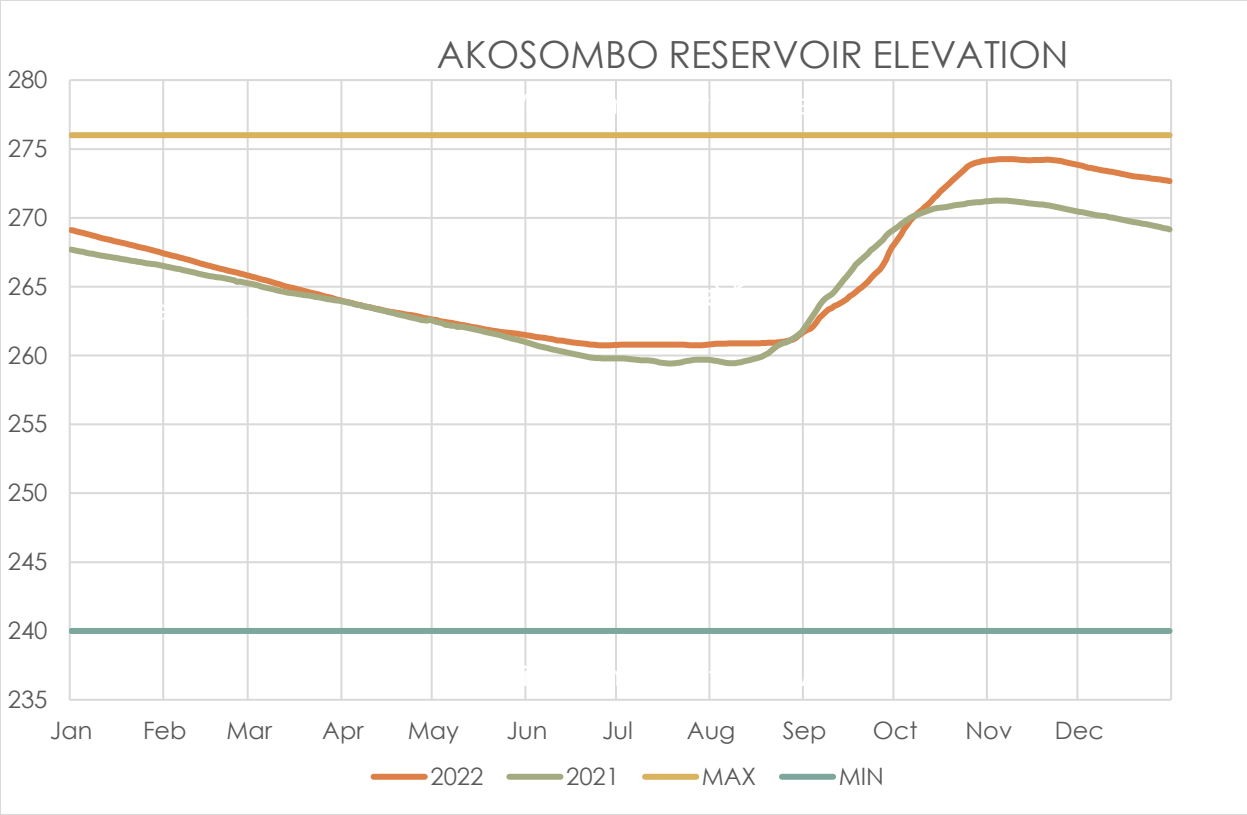


Figure 12: Akosombo Reservoir Elevation

The Bui Reservoir level at the beginning of 2022 was 177.6 masl. Based on the year start elevation and a plan to adopt a conservative approach towards the reservoir drawdown, Bui was expected to operate two (2) units at peak during 2021. However, due to system exigencies, the plant operated off-peak in addition to the peak requirements resulting in the reservoir dropping to a minimum water level of 170.3 masl on June 15, 2022 (end of the dry season). The minimum level reached was thus 0.8 m lower than the projected minimum of 171.2 masl for the year.

At the end of 2022, Bui Reservoir Elevation was 179.5 masl, which is 11.5 m above the minimum operating level (168 masl). The maximum level attained during the inflow season was 182.7 masl which occurred on October 26, 2022. Figure 13 shows the Bui reservoir trajectory in 2021 and 2022.

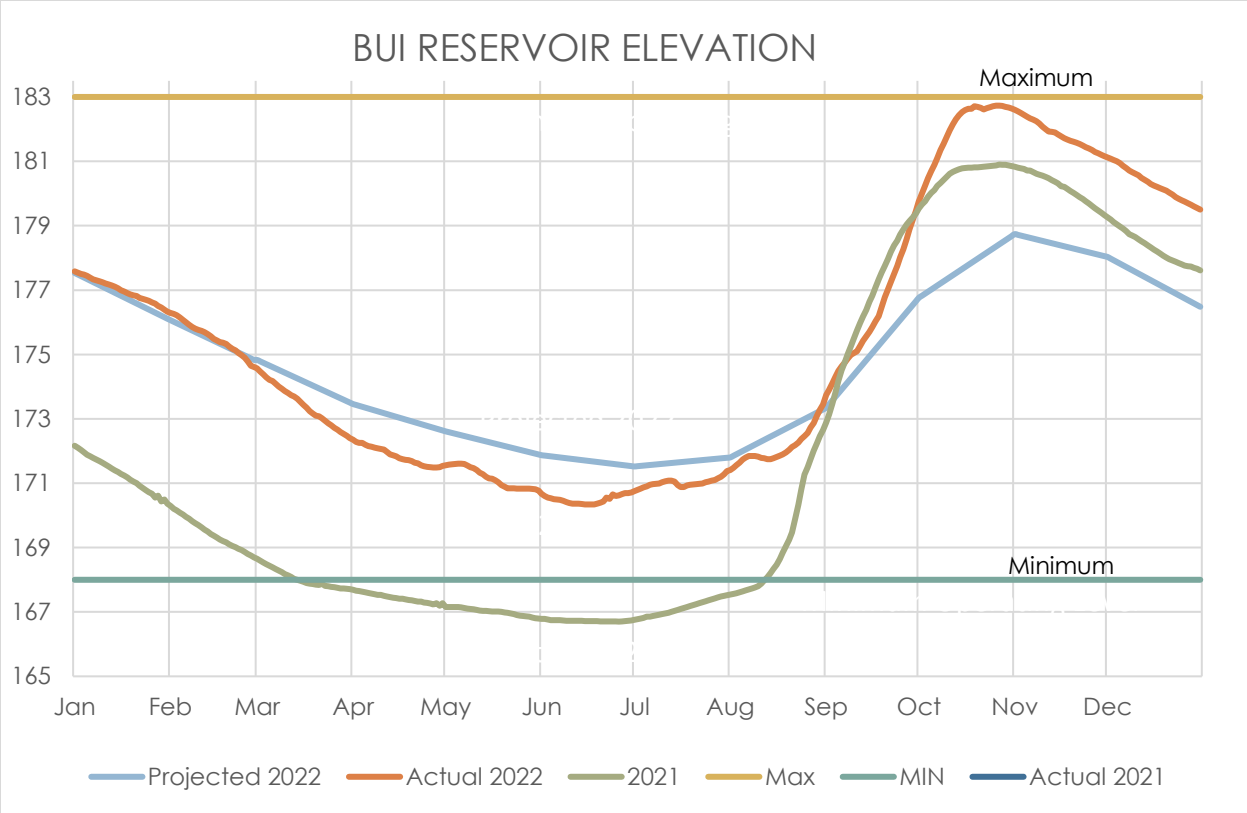
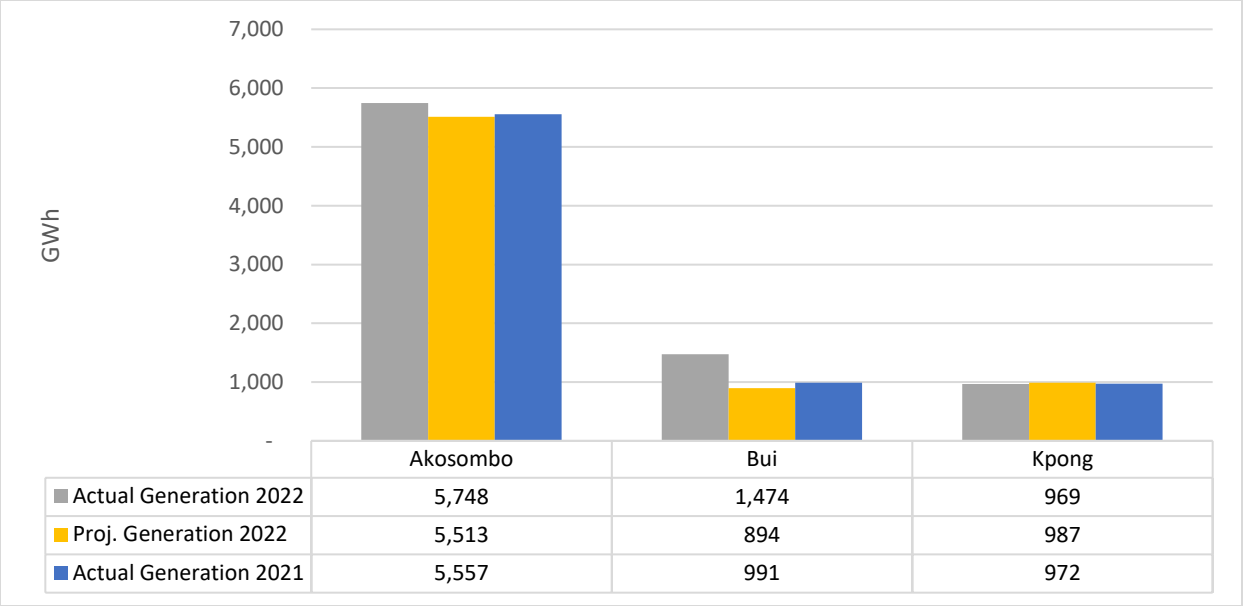


Figure 13: Bui Reservoir Elevation

Based on the planned mode of operations and elevations achieved, overall, hydro generation in 2022 was 8,192 GWh as against the projected generation of 7,394 GWh. This represents an 8.9% increase over what was generated in 2021. Figure 14 presents electricity generation from the three hydropower plants (Akosombo, Kpong and Bui) in 2022.



	Akosombo	Bui	Kpong
Actual Generation 2022	5,748	1,474	969
Proj. Generation 2022	5,513	894	987
Actual Generation 2021	5,557	991	972

Figure 14: 2022 projected and actual hydro generation

Akosombo hydropower plant produced 5,748 GWh in 2022 against the projected generation of 5,513 GWh. This represents a 4.2% increase in what was projected for the year and a 3.4% increase in the quantity generated in 2021. Kpong, generated 969 GWh against a projected generation of 987 GWh, representing 1.8% less than projected and 0.3% less than the generation in 2021. Bui hydro plant also generated 1,474 GWh compared to the projected generation of 894 GWh[3], representing 64.9% more than projected and 48.7% more than the generation in 2021.

2.2.3.2 Thermal Sources

Total grid electricity generated in 2022 from thermal plants (excluding the embedded generation of 656 MW) was 14,154 GWh, 11.5% less than what was projected for the year, and 2.2% higher than generation in 2021. Projected and actual generation from thermal plants in 2022 are presented in Figure 15.

[3] 2021 Electricity Supply Plan for the Ghana Power System
http://energycom.gov.gh/files/2020%20Supply%20Plan%20Mid%20Year%20Review.pdf

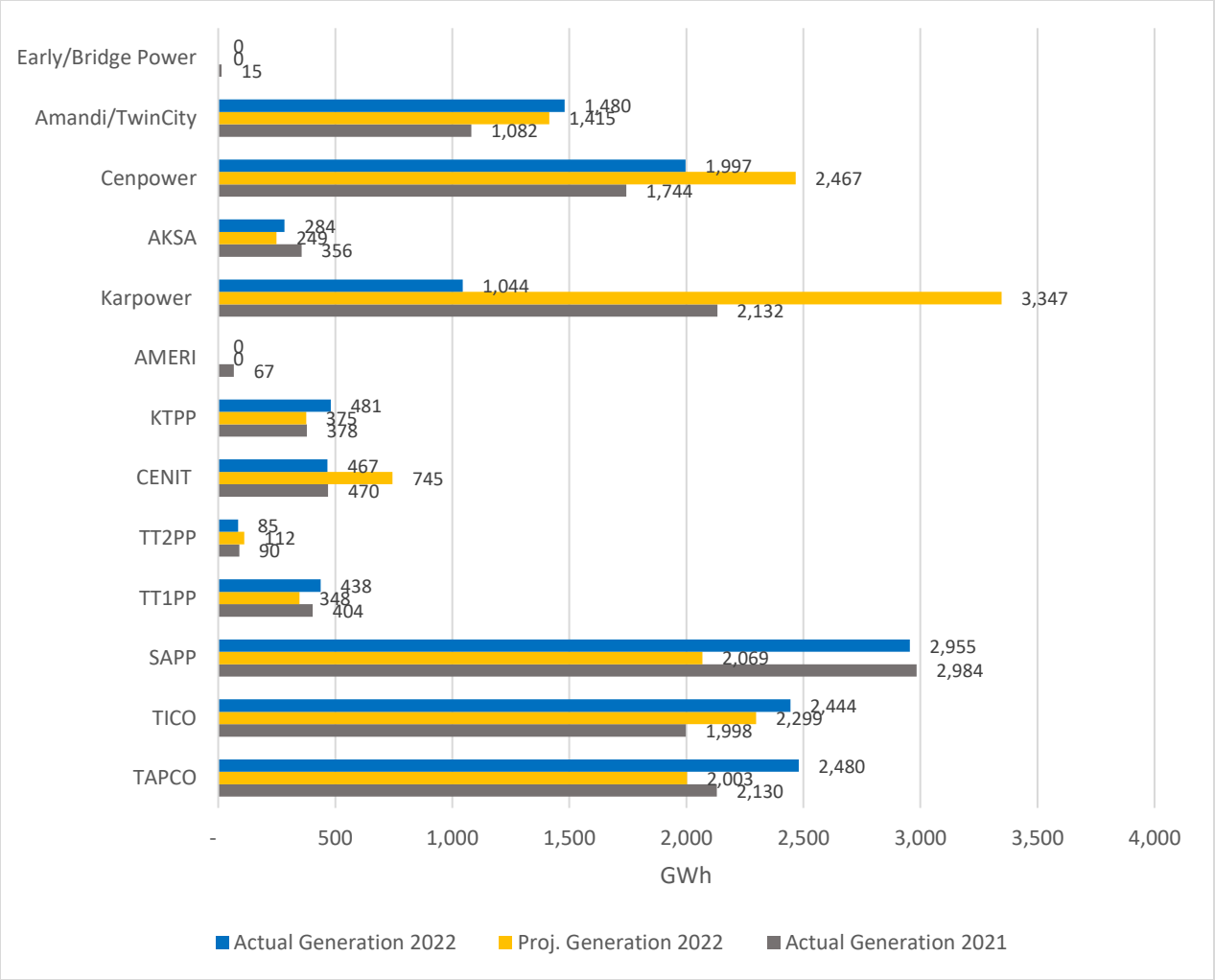
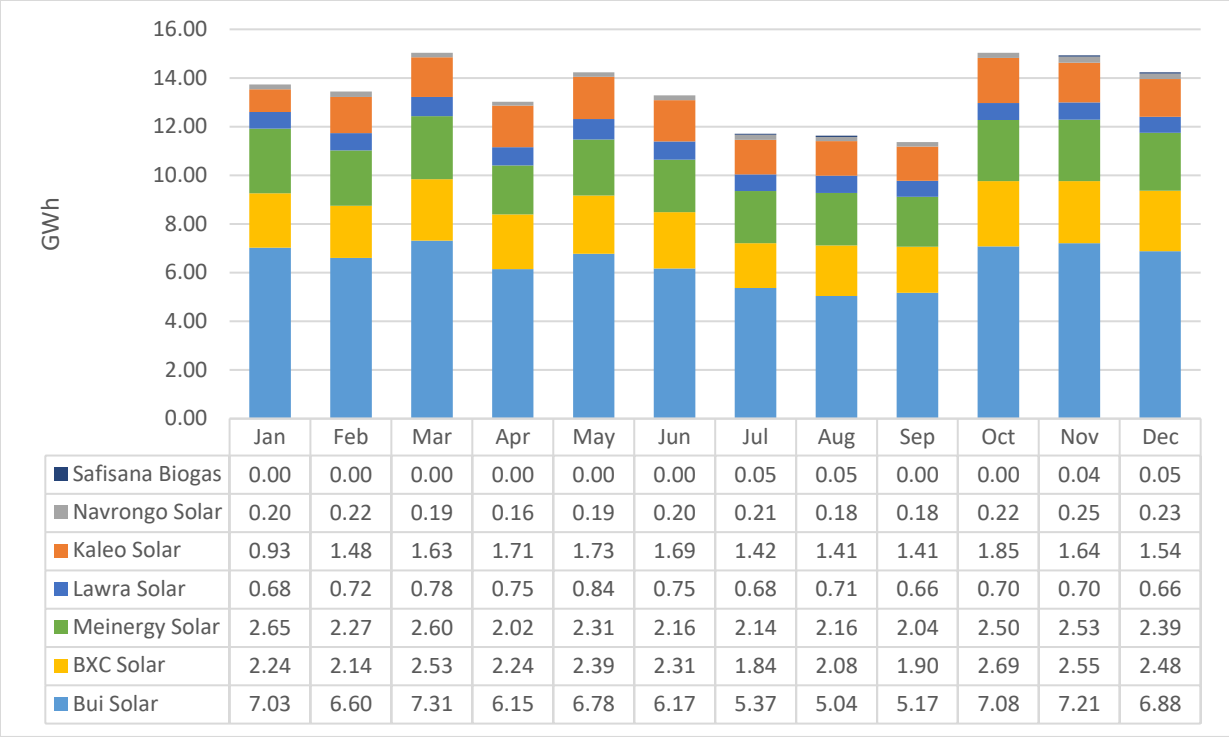


Figure 15: Projected and actual generation from thermal sources in 2022

2.2.3.3 Embedded Generation

Grid-tied embedded generation at the distribution level particularly solar, has become prominent in recent times. Generation increased from 122 GWh in 2021 to 162 GWh in 2022. Figure 16 details the existing embedded generators and their monthly energies delivered in 2022.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Safisana Biogas	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.04	0.05
Navrongo Solar	0.20	0.22	0.19	0.16	0.19	0.20	0.21	0.18	0.18	0.22	0.25	0.23
Kaleo Solar	0.93	1.48	1.63	1.71	1.73	1.69	1.42	1.41	1.41	1.85	1.64	1.54
Lawra Solar	0.68	0.72	0.78	0.75	0.84	0.75	0.68	0.71	0.66	0.70	0.70	0.66
Meinergy Solar	2.65	2.27	2.60	2.02	2.31	2.16	2.14	2.16	2.04	2.50	2.53	2.39
BXC Solar	2.24	2.14	2.53	2.24	2.39	2.31	1.84	2.08	1.90	2.69	2.55	2.48
Bui Solar	7.03	6.60	7.31	6.15	6.78	6.17	5.37	5.04	5.17	7.08	7.21	6.88

Figure 16: Monthly electricity generation from solar and biogas in 2022

2.2.3.4 Electricity Exchange

Electricity export to neighbouring countries declined from 1,855 GWh in 2021 to 1,734 GWh in 2022. Out of the total exported, 743 GWh was exported to Togo/Benin (CEB) as against 575 GWh exported in 2021. Export to Burkina Faso (SONABEL) increased by 25.2%, from the 962 GWh delivered in 2021, A total of 241 GWh was exchanged[4] between Ghana and Cote d'Ivoire (CIE) made up of 37 GWh of import and 267 GWh of export. Figure 17 presents the monthly export of electricity to SONABEL, CEB and CIE in 2022.

[4] Inadvertent exchange

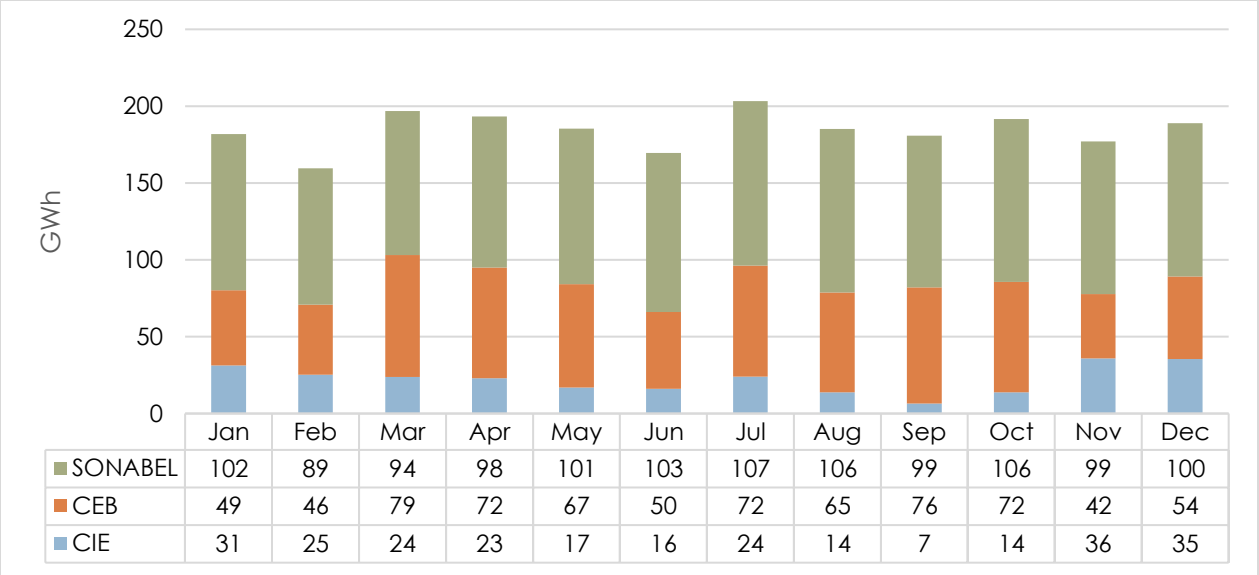


Figure 17: Monthly export of electricity to SONABEL, CEB and CIE in 2022

2.3 Fuel Supply in 2022

2.3.1 Fuel Consumption

The main fuel used by thermal plants are Natural gas, Light Crude Oil (LCO) and Heavy Fuel Oil (HFO). The majority of thermal plants depend on natural gas as the primary fuel source due to its comparative advantage over oil in terms of indigeneity, cost and environmental friendliness. The various fuels and their quantities consumed by the thermal plants for the year 2022 are shown in Table 2.

Table 2: Fuels used by the thermal plants in 2022

Power Plant	GAS		LCO		DFO		HFO	
	MMscf		Bbls					
	Projected	Actual	Projected	Actual	Projected	Actual	Projected	Actual
TAPCO	15,851	19,416	-	-	-	-	-	-
TICO	16,076	17,244	-	296	-	4	-	-
AMERI	5,714	-	-		-	-	-	-
TT1PP	3,598	4,957	-	-	-	-	-	-
TT2PP	1,166	863	-	-	-	-	-	-
KTPP	3,913	4,478	-	-	-	107,392	-	-

SAPP	15,166	20,834	-	-	-	-	-	-
CENIT	7,777	4,938	-	-	-	-	-	-
KARPOWER	23,927	7,680	-	-	-	-	-	-
AKSA	-	1,066	-	-	-	-	548,657	213,653
CENPOWER	17,953	13,502	-	139,984	-	7,388	-	-
AMANDI	10,312	10,197	-	44,906	-	417	-	-
BRIDGE POWER	-	-	-	-	-	-	-	-
GENSER	-	7,879	-	-	-	-	-	-
Total	**121,453**	**113,054**	-	**185,187**	-	**115,201**	**548,657**	**213,653**

Source: GRIDCo Daily Report

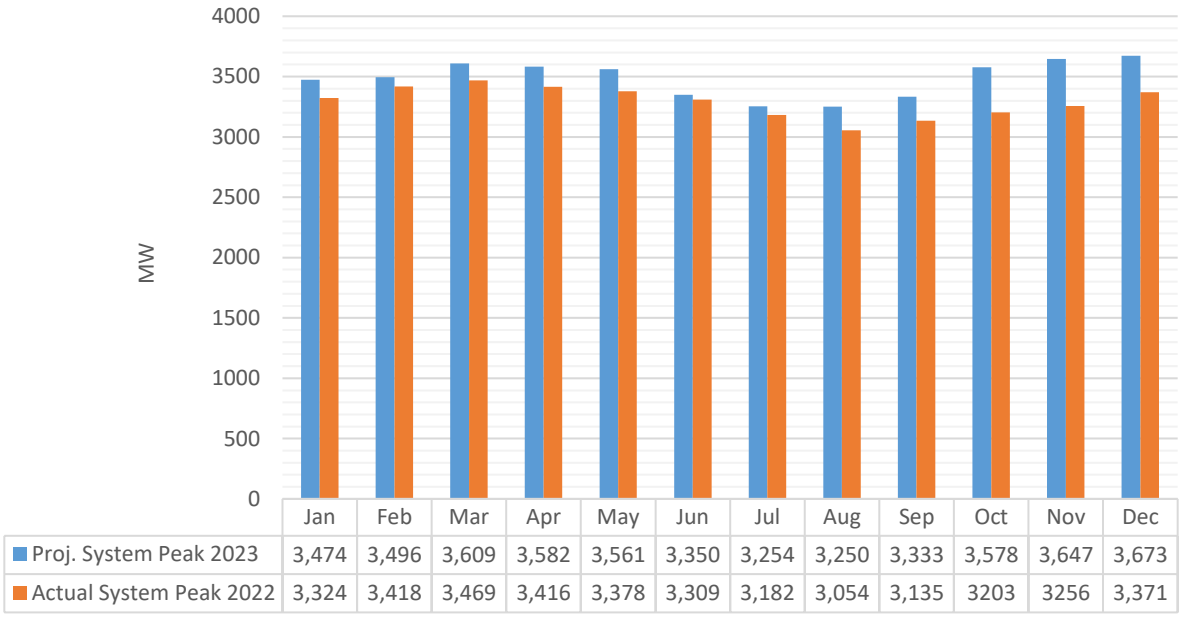
Natural gas used in 2022 for electricity generation was 113,054 MMscf, a 6.9% decrease from what was projected for the year, and 5.9% more than what was used in 2021. Though no LCO was projected for use in 2022, about 185,187 barrels were used with higher volumes going into the operation of the AMANDI and Cenpower generation plants. These plants might have resorted to the use of LCO due to gas supply interruption. A total of 115,201 barrels of DFO was used by KTPP for power generation. AKSA plant used, 213,653 barrels of HFO, which was below the 548,657 barrels projected, for the year.

Chapter Three: Electricity Outlook 2023

3.1 Electricity Demand Outlook

3.1.1 Projected Peak Demand for 2023

Ghana's system peak in 2023 is expected to be 3,673 MW. This represents an increase of 5.9% over the 2022 actual peak demand of 3,469 MW and is expected to occur in December 2023 (Figure 18).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Proj. System Peak 2023	3,474	3,496	3,609	3,582	3,561	3,350	3,254	3,250	3,333	3,578	3,647	3,673
Actual System Peak 2022	3,324	3,418	3,469	3,416	3,378	3,309	3,182	3,054	3,135	3203	3256	3,371

Figure 18: Monthly projected peak demand for 2023

ECG, NEDCo, Export and the Mines are expected to contribute 63.9% and 8.6%, 9.3% and 5.9% to the system peak respectively. VALCO operating on two pot-lines is expected to contribute 2.6% whilst other direct customers and transmission losses and network usage will contribute 3.1% and 4.8% of the system peak in 2023 respectively (Figure 19).

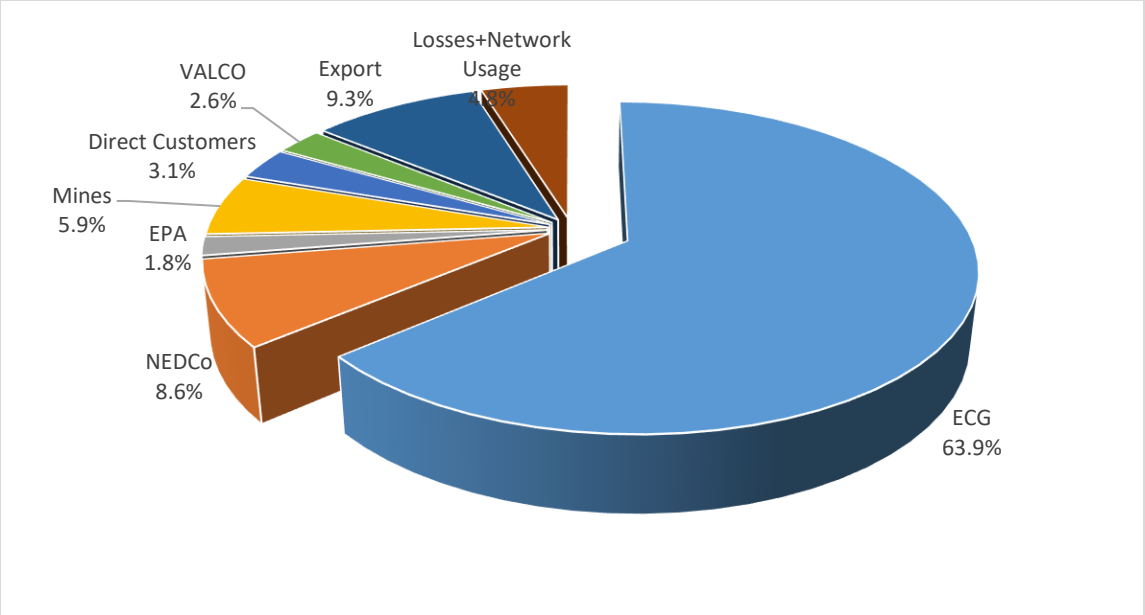
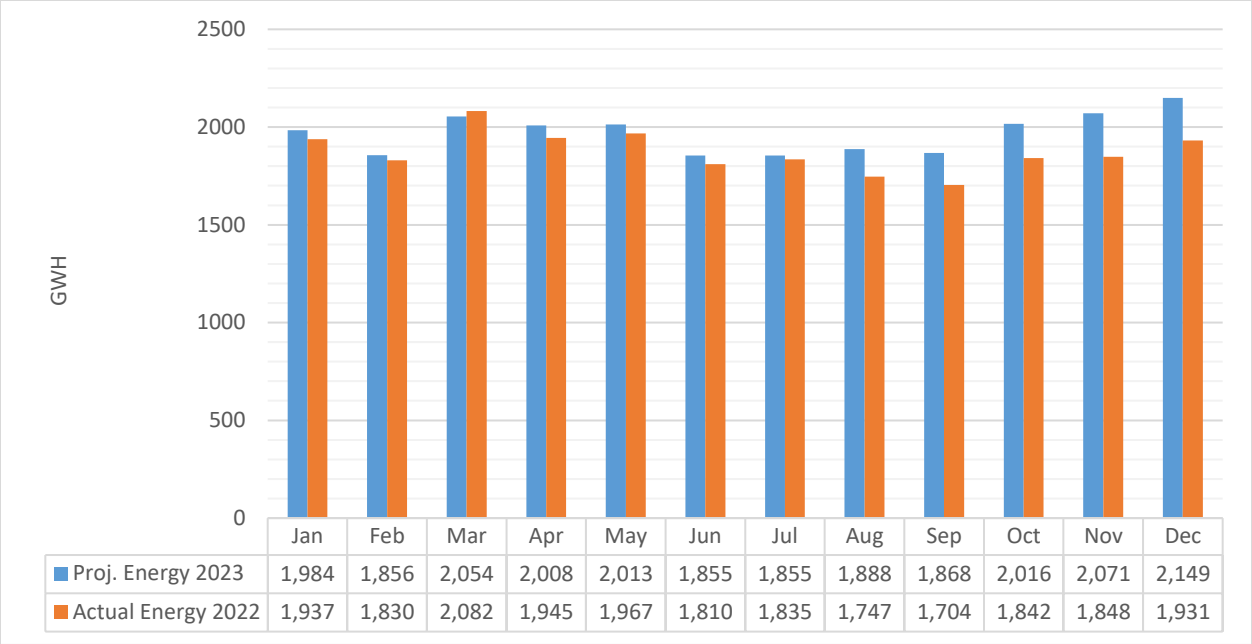


Figure 19: Share of projected peak demand by customer class

3.1.2 Projected Electricity Consumption for 2023

In 2023, 23,616 GWh of electricity (including transmission network losses and usage of 1,021 GWh), is projected to be consumed by bulk customers on the transmission system. The estimated transmission losses and network use would represent 4.3% of the total projected energy consumption. The projected energy consumption represents an increase of 5.1% over the 2022 consumption of 22,478 GWh. The expected monthly electricity consumption for 2023 is presented in Figure 20.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Proj. Energy 2023	1,984	1,856	2,054	2,008	2,013	1,855	1,855	1,888	1,868	2,016	2,071	2,149
Actual Energy 2022	1,937	1,830	2,082	1,945	1,967	1,810	1,835	1,747	1,704	1,842	1,848	1,931

Figure 20: Projected monthly energy consumption for 2023

ECG is projected to consume 15,375 GWh of electricity, representing 65.1% of the total projected energy consumption for 2023. NEDCo and Mines are projected to consume 1,908 GWh and 1,484 GWh of electricity, respectively, representing 8.1% and 6.3% of total consumption. Export (to Togo/Benin, Côte d'Ivoire and SONABEL) will constitute 9.9% of total consumption, whilst VALCO will use 3.6% of the projected total electricity consumption for the year. Energy losses are expected to constitute 4.3% of the total projected electricity supply, which is more than the PURC benchmark of 4.1% (Figure 21).

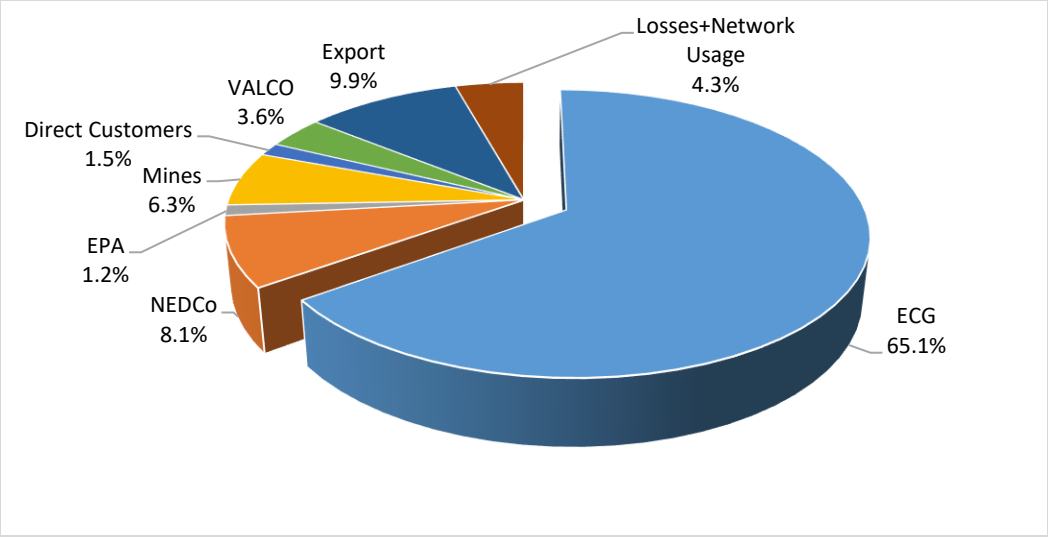


Figure 21: Share of projected energy consumption by the various customer classes

3.2 Electricity Supply Outlook

3.2.1 Generation Sources for 2023

Existing and committed power plants (plants expected to come online during the year) considered for electricity supply in 2023 are presented in Table 4. Generation from thermal sources will constitute 69.3% of total electricity generation capacity in 2023.

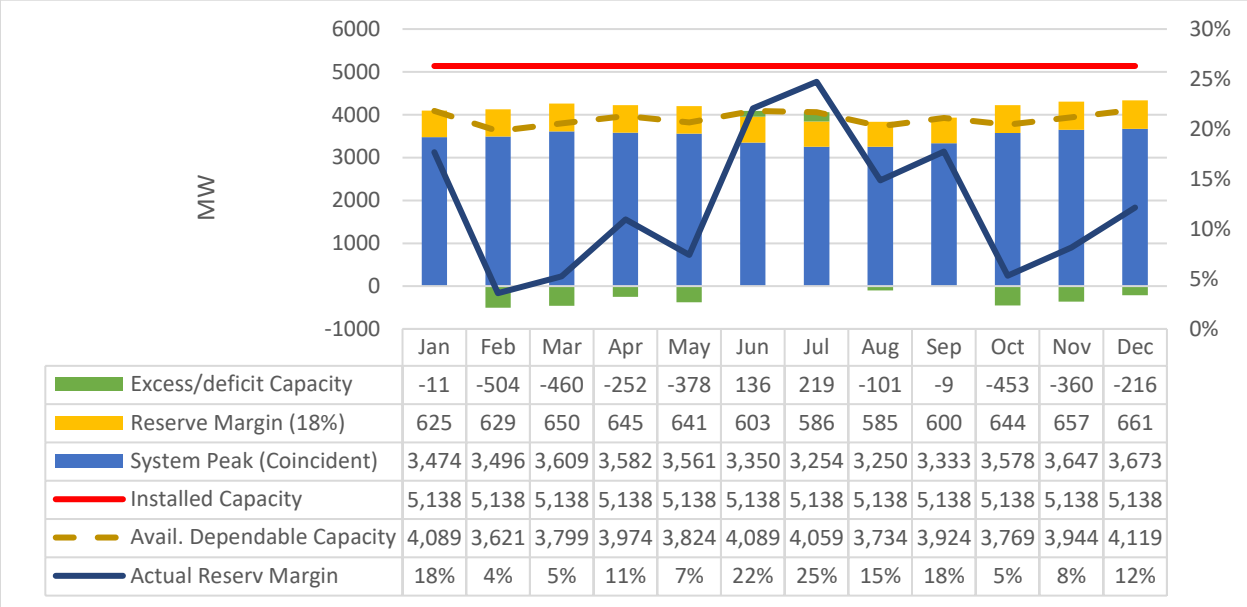
Table 3: Existing and committed power plants for 2023

Power Plant	Fuel Type	Installed Capacity (Nameplate)	% Share	Dependable Capacity
Hydro Power Plants				
Akosombo	Hydro	1,020		900
Bui	Hydro	404		330
Kpong	Hydro	160		140
	Sub-total	***1,584***	***28.7***	***1,370***
Thermal Power Plants				
Takoradi Power Company (TAPCO)	Oil/NG	330		315
Takoradi International Company (TICO)	Oil/NG	340		330
Sunon–Asogli Power (SAPP)	NG	560		530
Tema Thermal Plant1 (TT1P)	Oil/NG	110		100
Tema Thermal Plant2 (TT2P)	Oil/NG	87		70
CENIT Energy Ltd (CEL)	Oil/NG	110		100
KTPP	Oil	220		200
AMERI	NG	250		230
Karpower	NG/HFO	470		450
AKSA	HFO	370		330
Cenpower	Oil/Diesel	360		340
Amandi	Oil/NG	210		201
Early Power*	Gas/LPG	214		144
	Sub-total	**3,631**	**69.6**	**3,340**
Genser	NG/LPG	156		136
Trojan	Diesel/NG	44		39.6
Sub–total (incl. embedded gen.)		***3,831***	***69.3***	***3,516***
Renewables *(excl. large hydro)*				
VRA Solar (Navrongo)	Solar	2.5		-
Meinergy Solar	Solar	20		-
BXC Solar	Solar	20		-
VRA Solar (Lawra)	Solar	6.5		-
VRA Solar (Kaleo)	Solar	13		-
Tsatsadu Hydro	Hydro	0.045		-
Bui Solar	Solar	50		-
Safisana Biogas	Biogas	0.1		-
	Sub – total	***112.145***	***2.0***	**-**
Total (incl embedded gen.)		**5,527.15**		**4,885.6**
Total (excl embedded gen.)		**5,138.0**		**4,710.0**

*Being converted to run on natural gas and will not be available in 2023

3.2.2 Generation Capacity and Projected Peak Demand

Projected monthly dependable capacities, taking planned units' maintenance and fuel supply situation into consideration, are shown in Figure 22. The monthly demand and supply situation for 2023 gives monthly positive generation reserve margins ranging between 4% (125 MW) and 25% (805 MW). A reserve margin of 125 MW (5%) in March and 191 MW (5%) in October is due mainly to planned generation maintenance outages. Such a situation will require re-arrangement of non-critical outages or operating additional generation capacity on liquid fuel.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Excess/deficit Capacity	-11	-504	-460	-252	-378	136	219	-101	-9	-453	-360	-216
Reserve Margin (18%)	625	629	650	645	641	603	586	585	600	644	657	661
System Peak (Coincident)	3,474	3,496	3,609	3,582	3,561	3,350	3,254	3,250	3,333	3,578	3,647	3,673
Installed Capacity	5,138	5,138	5,138	5,138	5,138	5,138	5,138	5,138	5,138	5,138	5,138	5,138
Avail. Dependable Capacity	4,089	3,621	3,799	3,974	3,824	4,089	4,059	3,734	3,924	3,769	3,944	4,119
Actual Reserv Margin	18%	4%	5%	11%	7%	22%	25%	15%	18%	5%	8%	12%

Figure 22: Projected monthly available capacity versus system peak for 2023

However, planned gas supply outages due to maintenance works could lead to a generation capacity outage of up to 800 MW. This level of outage will erode all the generation capacity surplus if alternative fuel supply arrangement is not made to ensure plants are still in operation to meet demand.

3.2.3 Generation Sources Availability in 2023

3.2.3.1 Hydro Generation Sources

For the greater part of the year, 6 units at Akosombo GS will be available for power generation. This gives an operating capacity of up to 750 MW with an average capacity of 150 MW for each of the five available units. The Kpong hydro power plant (downstream of Akosombo) will have all its four units available in 2023, with a total capacity of 140 MW.

The elevation at Akosombo at the beginning of 2023 was 272.6 ft (83.1 m) which is 3.5 feet (1.1 m) higher than the 2022 start year elevation. The elevation is expected to drop by about 9.8 ft (3.0 m) per the projected generation. This will result in a projected minimum elevation of 262.8 ft (80.1 m) by year-end. Figure 23 presents the projected Akosombo reservoir trajectory for 2023.

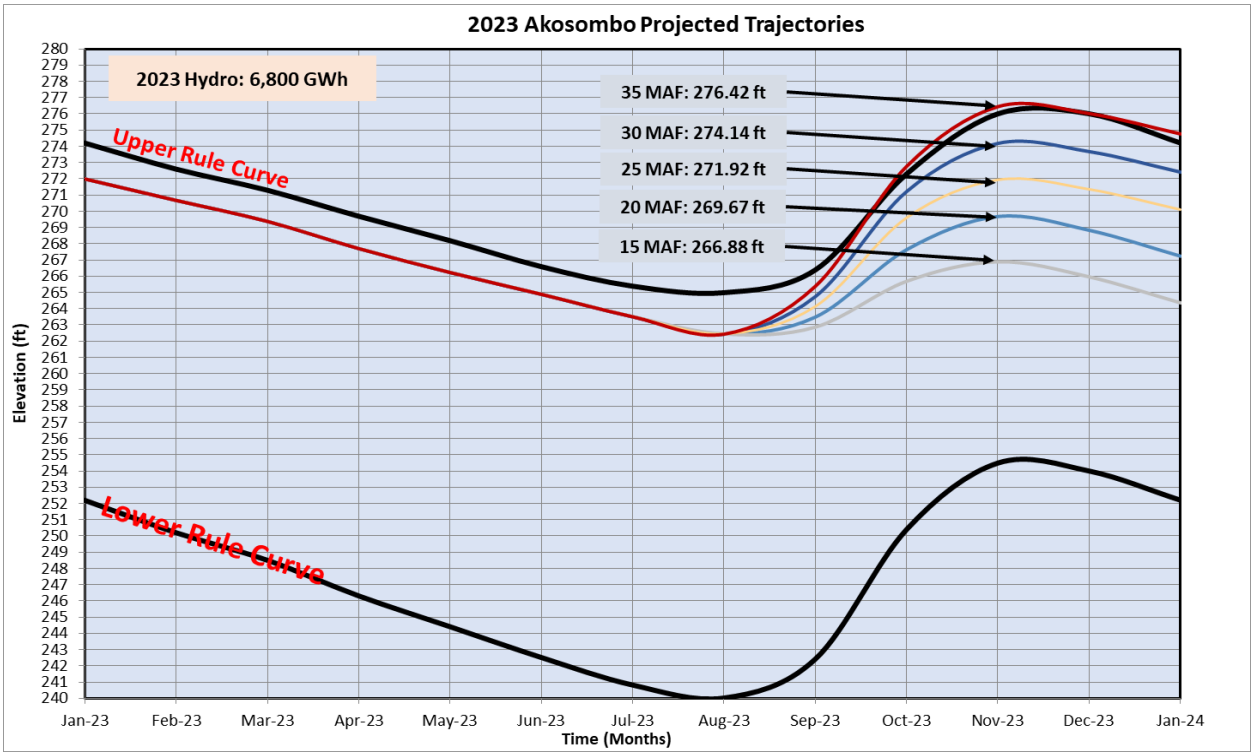


Figure 23: Akosombo reservoir trajectory for 2023

The year-start elevation of the Akosombo reservoir is high, about 3.4 feet (1.0 m) below the Upper Rule Curve. This poses a risk of water spilling from the reservoir if very high inflows are recorded in 2023.

Further analysis showed that inflows above 35 MAF are likely to lead to spillage from the reservoir in 2023. It would be necessary to achieve the planned level of generation at the Akosombo and Kpong hydro stations to reduce the likelihood of spilling.

Bui hydro power plant is expected to operate one unit off-peak and a maximum of two units at peak for the greater part of 2023. In critical situations, all three units will be dispatched to meet demand. The station will continue with planned Level 'A' maintenance in the first and second quarters of the year. The projected annual generation assumes that the Turbinette will operate at 3.75 MW for 24 hours/day throughout the year 2023.

At a year start elevation of 179.45 masl, the projected minimum elevation of the Bui reservoir at the end of the dry season is 168.5 masl. Bui reservoir trajectory for 2023 is presented in Figure 24.

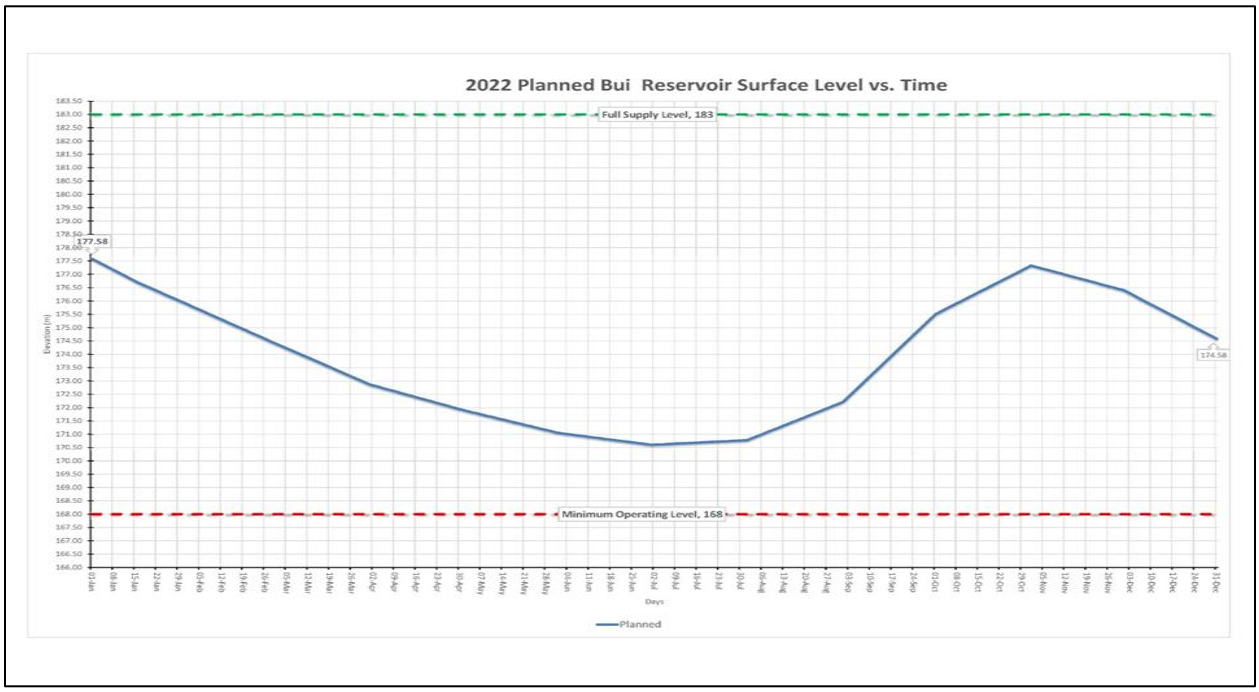


Figure 24: Bui reservoir trajectory

3.2.3.2 Thermal Generation Sources

The total dependable capacity for existing thermal plants is 3,340 MW. Early power, also known as Bridge power, is expected to commission a 144 MW thermal power plant in the course of the year. However, due to delays encountered with respect to the conversion of the plant from running on LPG to Natural gas, the plant is not expected to operate this year.

3.2.3.3 Renewable Generation Sources

Electricity generation from renewable sources in 2023 is expected to come from the 112 MWp renewable generation plants available at the beginning of the year. VRA has a total of 22 MW of solar plants made up of a 2.5 MWp plant at Navrongo, 6.5 MWp at Kaleo and a 13 MWp plant at Lawra. The VRA also intends to commission another 15.8 MWp plant at Kaleo by the end of March 2023 This will increase VRA's renewable generation capacity to 37.8 MWp, and also add to the quantity of electricity to be generated from renewable sources.

BPA also has a 50 MWp Bui Solar PV farm located at Bui. It is expected to add an additional 50 MWp by the end of October 2023. Generation is also expected from the two 20 MW BXC and Meinergy solar plants, as well as the 0.1 MW Safisana Biomass plant.

3.2.3.4 Electricity Exchange

Power import in 2023 is not anticipated. However, inadvertent energy exchanges on tie-lines could result from transient flows. Emergency imports may be necessitated as a result of short-term capacity shortages caused by faults or fuel supply contingencies.

3.2.4 Demand-Supply Balance for 2023

The criteria to be used to determine which power plants would be dispatched on a monthly basis during the year are as follows:

i. Power plant nomination based on off-takers requirements
ii. Availability of fuel for power plants
iii. Must-run plants (e.g., solar)
iv. System stability requirements
v. PURC and EMOP energy allocation for the year

It should be noted that in instances where there is a supply surplus, some plants would not be dispatched. The electricity demand-supply balance for 2023 is presented in Table 4.

Table 4: 2023 Projected electricity demand/supply balance, GWh

Customer Class	**Demand/Supply**
Domestic	20,426.3
VALCO	860.6
Export (CEB+CIE+SONABEL)	2,329.6
Total Energy Requirement	***23,616.5***
Projected Generation	
Akosombo	5,810.6
Kpong	989.4
Bui	1,225.0
Sub-total	***8,025.0***
TAPCO	1,893.3
TICO	2,414.9
TT1PP	336.6
KTPP	404.0
TT2PP	75.9
AMERI Power Plant	259.0
SAPP	3,989.3
CENIT	73.7
Karpower Barge	1,430.1
AKSA	173.9
CEN Power	2,774.8
Amandi	1,414.7
Early Power	-
Sub-total	***15,244.4***
Renewable	
VRA Solar (Navrongo)	3.0
VRA Solar (Kaleo A)	21.8
VRA Solar (Kaleo B)	21.4
VRA Solar (Lawra)	10.2
Bui Solar	186
BxC Solar	27.0
Safisana	0.7
Meinergy Solar	27.0
Sub-total	***297.1***
Grand Total	**23,616.5**

Hydro generation for 2023 is expected to be 8,025 GWh, down from 8,192 GWh in 2022. A greater portion of electricity generation would come from thermal sources. Total generation from thermal is projected to be 15,244 GWh, an increase of 7.7% over the 2022 generation of 14,154 GWh. With the coming onstream of the 15.8 MWp VRA Kaleo solar plant and the 50 MWp Bui solar plant in the course of the year, generation from renewable sources is expected to be 297 GWh, in 2023 up from 95 GWh in 2022. Figure 27 shows the share of generation from various sources.

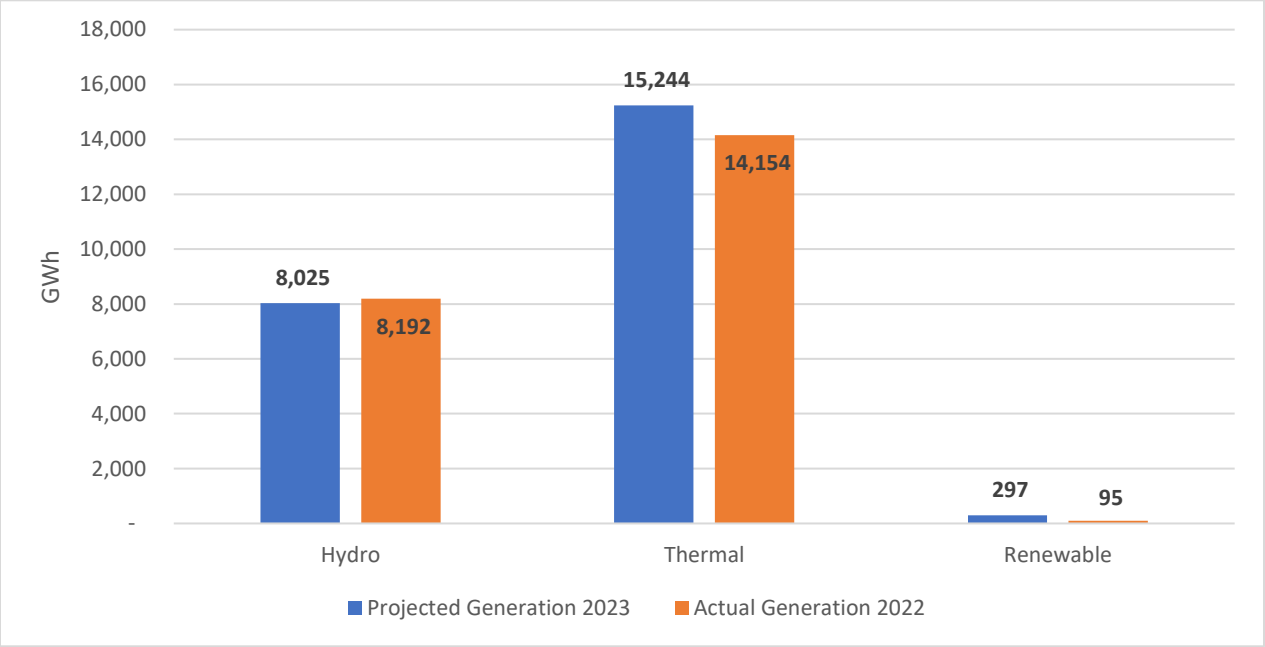


Figure 25: Projected electricity generation for 2023

Thermal generation and hydro generation would constitute 64.7% and 34.1% of total generation in 2023. (Figure 26). Generation from renewable sources (solar PV and Biogas) would constitute 1.3% of total electricity generation. This indicates the dominance of thermal generation in Ghana's overall generation mix and consequently the critical role that fuel availability to the thermal plants plays in power supply reliability and supply security in the Ghana power system.

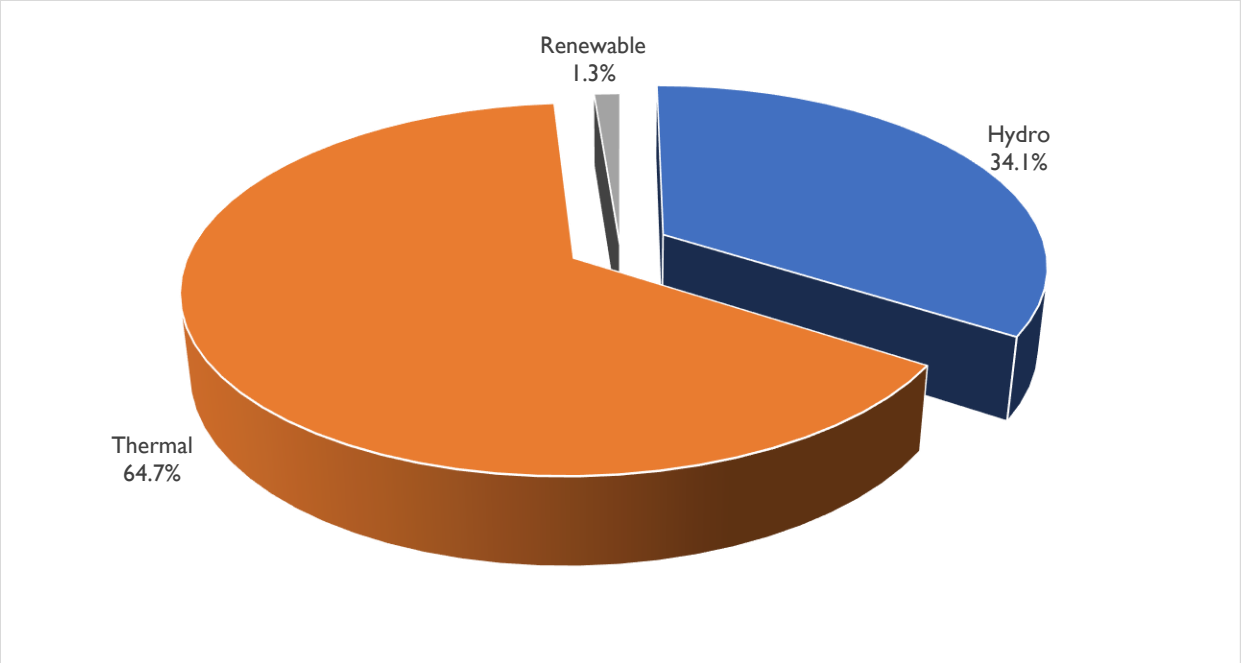
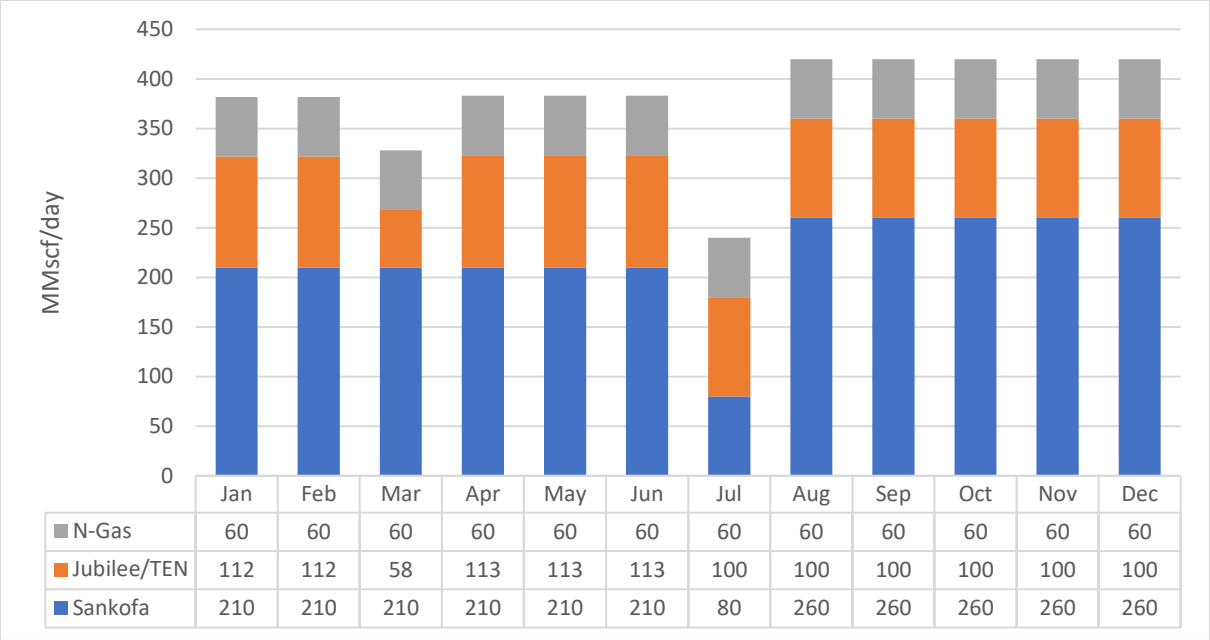


Figure 26: Share of electricity supply by generation type in 2023

3.3 Fuel Supply Outlook

3.3.1 Fuel Requirements

Natural gas will continue to be the dominant fuel for thermal electricity generation in 2023. It is expected to come from indigenous gas fields (Jubilee, TEN and ENI Sankofa) and import through WAGP. Figure 26 shows the expected natural gas flow rates from the various sources for power generation.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
N-Gas	60	60	60	60	60	60	60	60	60	60	60	60
Jubilee/TEN	112	112	58	113	113	113	100	100	100	100	100	100
Sankofa	210	210	210	210	210	210	80	260	260	260	260	260

Figure 27: Natural gas flowrates for thermal power plants in 2023

Gas supply from the Jubilee and TEN fields is limited to 108 MMscf/day in line with the AGPP operating capacity of 135 MMscf/day of raw gas. Sankofa field is expected to maintain its capacity to supply up to 210 MMscf/day. The supply of natural gas is expected to be bolstered from August 2023 by an additional 50 MMscf/day from the Sankofa field. GNPC and its Sankofa Partners have scheduled a debottlenecking and upgrade of the gas production and processing system to increase supply from the field. Import from Nigeria through the WAGP is expected to average 60 MMscf/day throughout the year.

Based on the projected gas supply from domestic and import sources, the total natural gas requirement for power generation for 2023 is projected to be 128.5 Tbtu. The total fuel requirement for each thermal plant is shown in Figure 28.

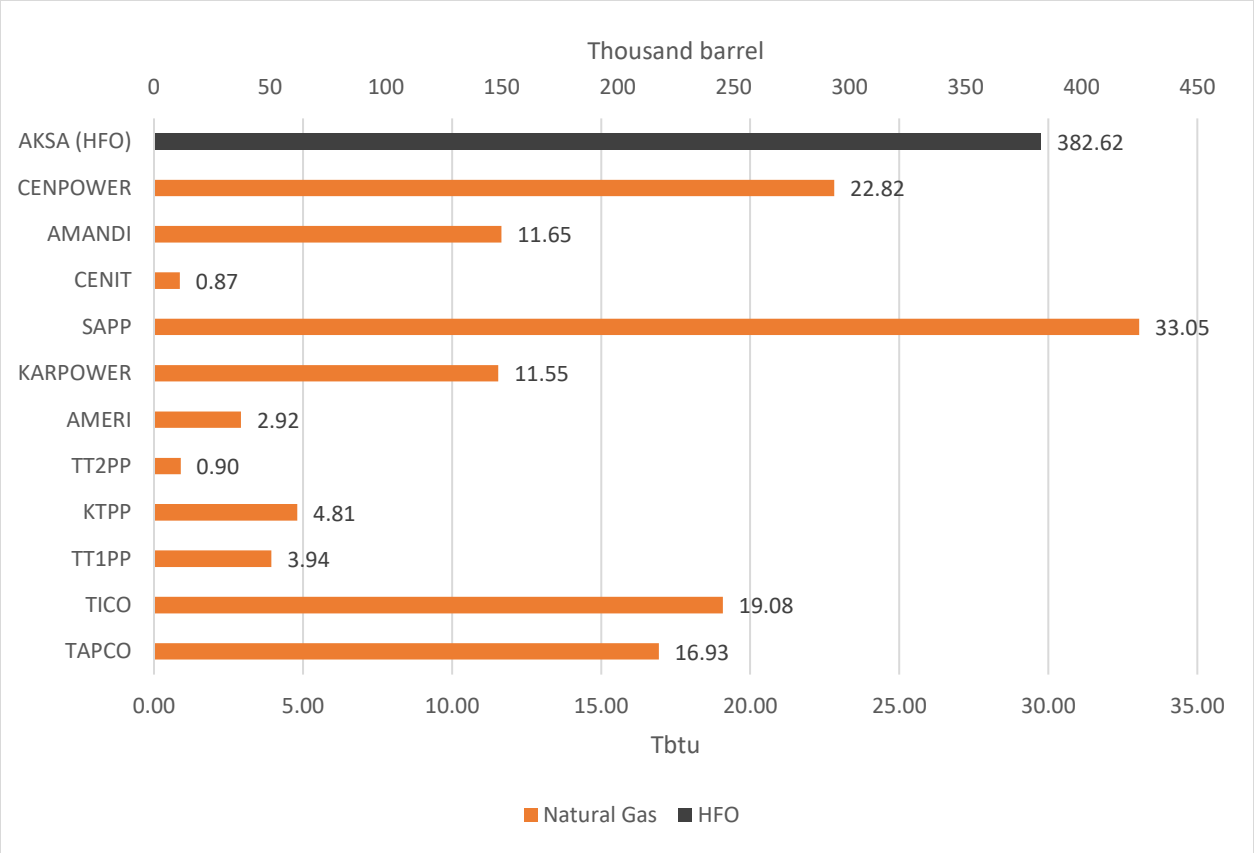


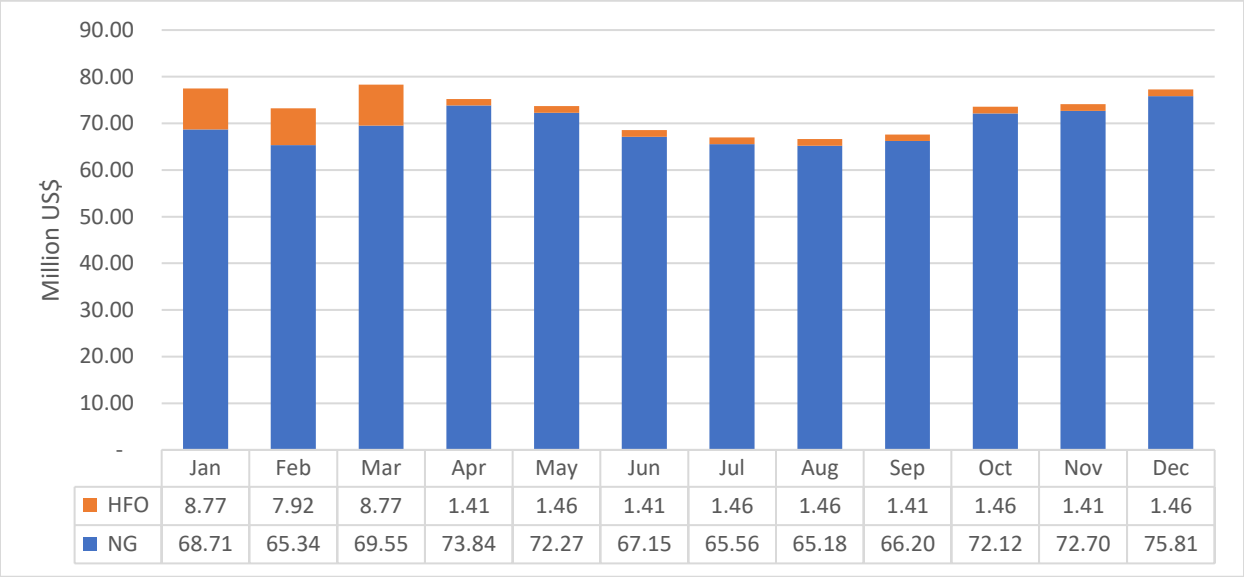
Figure 28: Thermal plants' fuel requirements for 2023

AKSA which runs on HFO is expected to operate as a standby plant in 2023. The plant will require a total of 382,619 barrels in the year. Light crude oil (LCO) and diesel would be required as backup fuels for some plants because of anticipated gas supply outages. About 2,985,170 barrels of LCO and 138,700 barrels of diesel would be needed to support the operation of about 700 MW generation capacity to cover the anticipated duration of gas supply disruptions in the course of the year.

3.3.2 Fuel Price and Cost

About US$817.8 million would be needed for gas procurement in 2023. This translates to a monthly average of US$68.2 million. HFO for the running of the AKSA plant would be procured at an expected delivery price of US$70/barrel and about $38.40 million will be required to procure HFO. Overall, an amount of US$872.83 million is required to purchase fuel for thermal

power generation. Figure 28 presents the monthly total cost of natural gas and HFO required to run the thermal plants in 2023.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HFO	8.77	7.92	8.77	1.41	1.46	1.41	1.46	1.46	1.41	1.46	1.41	1.46
NG	68.71	65.34	69.55	73.84	72.27	67.15	65.56	65.18	66.20	72.12	72.70	75.81

Figure 29: Expected monthly total cost of natural gas and HFO for the thermal plants for 2023

3.3.3 Gas Infrastructure Maintenance for 2023

Planned maintenance activities for the year 2023 include:

1. The OCTP FPSO and ORF are to be shut down for maintenance for 18 days from the 14th to the 31st of July 2023. This will curtail gas export from the Sankofa production facility resulting in the loss of 210 MMscf/day (the equivalent of circa 1050 MW). The Sankofa FPSO is expected to shut down for an upgrade for 4 days in September 2023. This will result in the loss of 210 MMscf/day of gas. Liquid fuel would be required for thermal generation during this period. Also, generation from hydro sources has to be stepped up.

2. TEN FPSO is expected to shut down for maintenance for 14 days in July 2023. The shutdown of TEN will not affect the gas supply.

3. GNGC's Takoradi Distribution Station (TDS) will be shut down for maintenance from 12th to 24th April 2023, resulting in intermittent flow reduction for Amandi and

Karpowership plants. Also, GNGC plans to carry out a maintenance programme for the Atuabo Gas Processing Plant (AGPP) to be scheduled for a period of 14 days in July 2023. This will lead to a loss of 100 MMscf/day. This will potentially affect the domestic gas supply which will require an increased flow from N-gas.

4. The West African Gas Pipeline (WAPCo) will conduct its semi-annual Emergency Shutdown (ESD) for valve maintenance in July 2023. WAPCo has also provided a shutdown programme scheduled in quarter four for the replacement of defective valves at the Takoradi and Tema stations. In both instances, there will be no gas transmission to WAPCo Takoradi station. Hence reverse flow of circa 80 MMscfd will be lost and will be for a brief period. This will affect gas supply to the East necessitating an increased flow from Nigeria.

5. WAPCo is expected to conduct maintenance activity between Ikoki and Lagos beach compressor station lasting 48 hours in February 2023. No effect on gas supply is expected provided a domestic supply of gas is maintained and hydro generation sources are stepped up.

3.4 Transmission Outlook

3.4.1 Overview of Transmission System

The National Interconnected Transmission System (NITS) is the backbone for transmitting electricity from various generating stations to load centres. Electricity transmission is done at three main voltage levels; 69 kV (3.0% of total transmission circuit length), 161 kV (73.2% of total transmission circuit length) and 330 kV (22.5% of total transmission circuit length). There is also a 225 kV (1.3% of total transmission circuit length) that facilitates interconnection with Ghana's western neighbour Cote d'Ivoire and northern neighbour Burkina Faso. There is also an interconnection with Togo through two 161 kV lines and a 330 kV line. The 330 kV interconnection with Togo was constructed as part of activities towards the implementation of the West African Power Pool (WAPP). The NITS, as of the end of the year 2022 was made up of:

- Total transmission circuit length of 7,200.5 km;
- Total number of Bulk Supply Points (BSPs) of 65;
- Total number of load transformers at BSPs - 138;
- Total transformation capacity – 8,901.8 MVA;
- Total capacity of fixed capacitive compensation devices – 309.8 MVAr;
- Total capacity of reactors - 230 MVAr;
- One 40 MVAr Static Synchronous Compensator (STATCOM1) installed at the Tamale substation.

3.4.2 Transmission Line Feeder and Substation Availability in 2023

The criteria used for ensuring high transmission Line, Feeder and Substation availability are as follows:

- All existing transmission lines are expected to be in service in 2023 to ensure transmission of electricity from the generation stations to the Bulk Supply Points across the nation and to enable the execution of power exchanges with neighbouring countries.
- Maintenance work on transmission lines and substations is to be organised in order not to significantly affect power supply to customers except for single transformer substations and consumers served on radial lines.
- 161 kV Konongo Kumasi Line is out of service in the 1st Half analysis.
- 161 kV Anwomaso Kumasi line is out of service in the 2nd Half analysis.
- 161 kV Kasoa – Mallam Lines are out of service in the 2nd Half analysis.

Most transformers in operation on the NITS are designed with a capability of 100% continuous loading and Transformer Utilization Factor (TUF). Indications from GRIDCo therefore, suggest that there is adequate transformer capacity on the NITS for the supply of power under normal operating conditions.

3.4.3 Transmission Losses in 2023

Analysis of the transmission network indicates that the lowest losses are registered on the NITS in the Balanced Generation scenario. This means that in situations where there are gas interruptions which affect thermal generation and compel high volumes of generation from a particular enclave (West or East), losses increase significantly. The relocation of Ameri to Kumasi to create another generation enclave is expected to reduce losses on the NITS further.

GRIDCo is embarking on a number of projects which are expected to improve the reliability, transfer capacity, reduce losses and improve voltages on the NITS. These include:

- 161kV Kasoa Substation with 50MVAr SVC Plus,
- Upgrade of the 161kV Achimota-Mallam transmission corridor,
- Western Corridor Transmission system upgrades (GRIDCo is on the verge of securing funds with the assistance of the Ministries of Energy & Finance) to upgrade the old 161kV lines from the Takoradi Thermal plant through Prestea to New Obuasi along with substation upgrades and
- The Siemens projects for the development of the 330/161kV Dunkwa II substation, 3rd BSP in Kumasi and the replacement of the 161kV capacitor bank in Kumasi with a 50MVAr SVC Plus.

3.5 Electricity Supply Challenges in 2023

3.5.1 Fuel Supply Challenges

Hydro Fuel Risk

Even though there are high prospects for rainfall this year, it would still be prudent to continue the conservative dispatch of the hydro plants to ensure that the reservoirs are not drawn down below their minimum operating levels to guarantee sustainable operations in the coming years. The availability and reliability of the thermal units are also very key to maintaining the planned hydro draft rate.

Thermal Fuel Risk

Reliable gas supply from domestic and import sources remains a major risk to the country's electricity supply reliability. Although there is a relatively high installed generating capacity, gas supply sustainability remains one of the major risks to reliable electricity supply in the country. Any disruptions in fuel supply would render some thermal plants inoperable, which will negatively impact supply reliability.

Any disruption can be averted by securing an alternative fuel supply to make up for any shortfall in gas supply within the period.

3.5.2 Transmission Challenges

- The loss of the 330 kV Takoradi Thermal – Anwomaso line results in the rerouting of almost all the power on the 330 kV circuit to the 161kV circuit between Aboadze Enclave and Kumasi. This leads to overloads along the 161kV line circuit in the Western corridor. This will lead to system disturbances triggered by congestion on the 161 kV lines between Takoradi Thermal and Prestea. The solution is to break into the 330 kV Takoradi Thermal – Anwomaso line at Dunkwa with a connection to the 161kV network at the existing Dunkwa substation and the upgrade of the 170 MVA Western corridor lines.

- The loss of the 330 kV Anwomaso - Kintampo transmission line will result in re-routing on the 161 kV circuit between Anwomaso and Kumasi, severely overloading the line as well as the 330/161kV Autotransformers at Anwomaso. Breaking into the 330 kV Takoradi Thermal - Anwomaso line at Dunkwa minimizes the impact of the line outage. The permanent solution is to upgrade the 161 kV circuit between Anwomaso and Kumasi and develop a 3rd bulk supply point for Kumasi at the 330 kV level.

- Loss of the 330 kV A4 – Volta Line overloads the 170 MVA low capacity Achimota – Accra Central and Achimota – Mallam lines. With the loss of this line, the load at A4BSP would have to be served from Aboadze. There is significant power flow on the Achimota – Accra Central and Achimota – Mallam lines. Upgrade of the 170 MVA lines is required to avert system disturbance.

- Loss of the 330 kV Kintampo – Tamale line overloads the 161 kV low capacity between Kintampo and Tamale and cause eventual system disturbance. A second 330 kV line is required from Aboadze to Bolgatanga to avert this disturbance.

- A loss of the 161 kV Tarkwa – Prestea line results in overload on the parallel 170 MVA Tarkwa – New Tarkwa – Prestea line circuit which causes it to trip. This situation will be mitigated by a break into the 330kV Takoradi Thermal – Anwomaso line at Dunkwa. The 161kV Aboadze-Takoradi-Tarkwa -New Tarkwa - Prestea lines will however require an upgrade in the medium term.

- A contingency on this line overloads the smaller capacity 161kV Takoradi Thermal - Takoradi and Takoradi - Tarkwa lines. This will eventually cause these lines to trip on overload. Upgrade of the Western corridor lines will avoid any system disturbances.

- Loss of the 330 kV Adubiyili - Nayagnia line overloads the 161 kV low capacity between Tamale and Bolgatanga and causes eventual system disturbance. A second 330 kV line is required from Takoradi Thermal to Nayagnia to avert this disturbance.

Chapter Four: Petroleum Sub-sector Performance 2022

4.1 Crude Oil

4.1.1 Crude Oil Production

The total volume of crude oil produced from the three commercial fields - Jubilee, TEN and Sankofa in 2022 was 51.76 million barrels, lower than the 55.05 million barrels produced in 2021 (Figure 29). The decrease in production is in line with the trend observed since the advent of COVID-19. Figure 30 shows the monthly production of crude oil from the three fields in 2022.

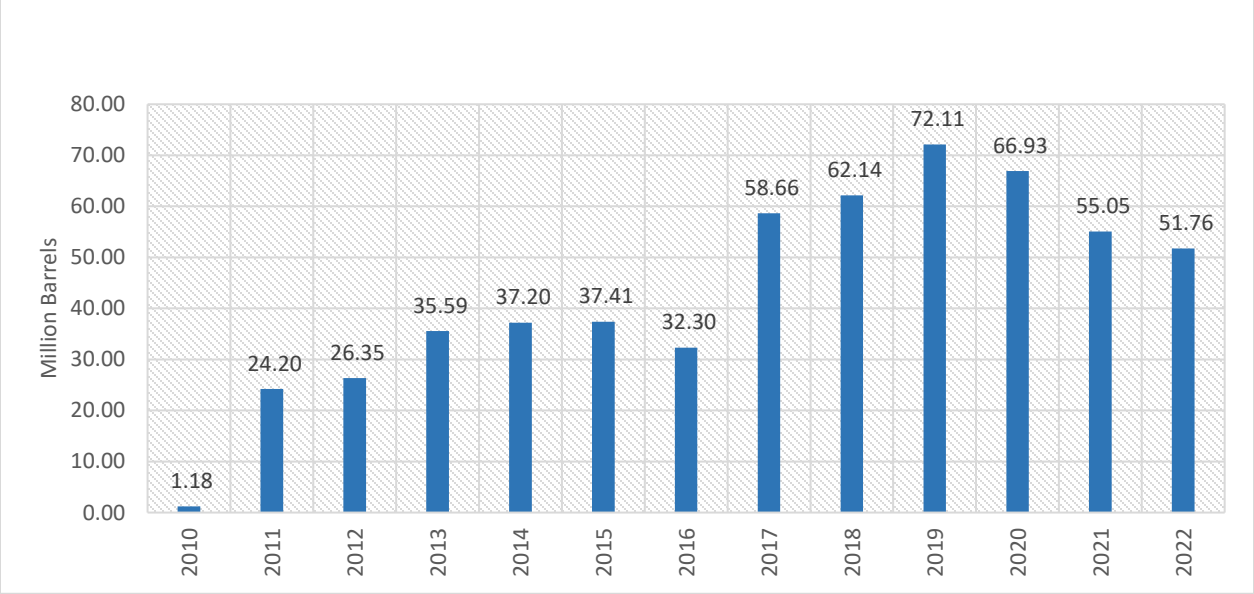
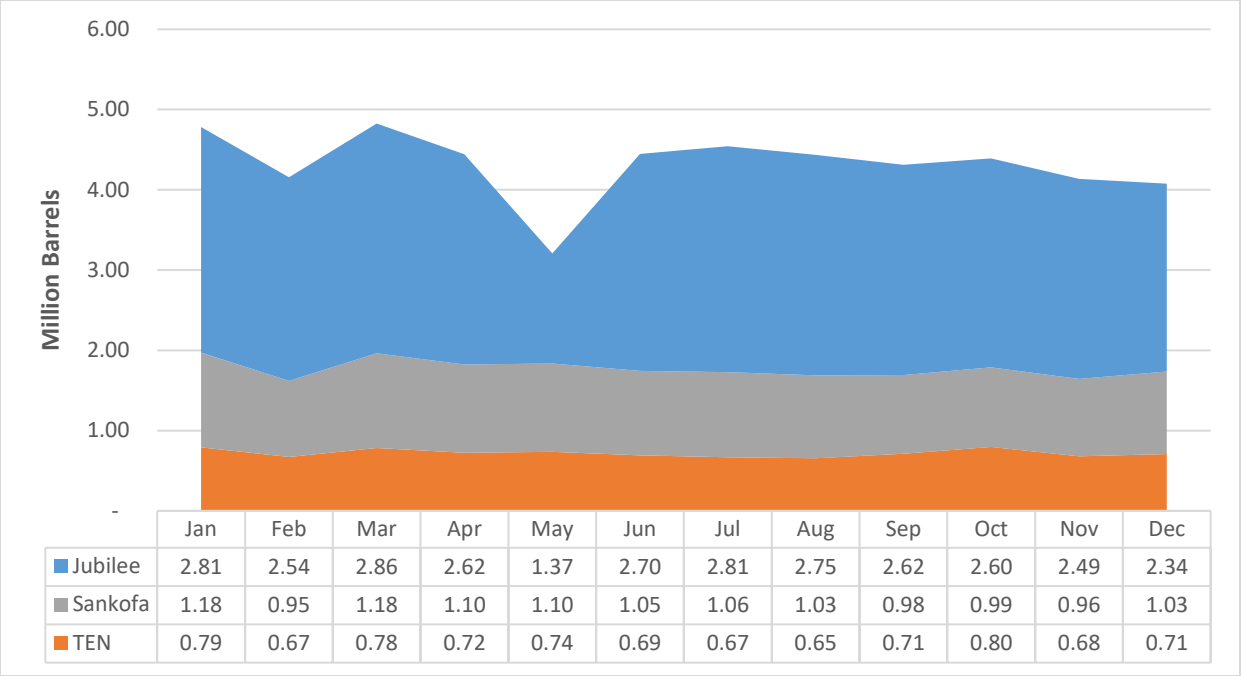


Figure 30: Crude oil production from 2010 to 2022

Source: Petroleum Commission



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jubilee	2.81	2.54	2.86	2.62	1.37	2.70	2.81	2.75	2.62	2.60	2.49	2.34
Sankofa	1.18	0.95	1.18	1.10	1.10	1.05	1.06	1.03	0.98	0.99	0.96	1.03
TEN	0.79	0.67	0.78	0.72	0.74	0.69	0.67	0.65	0.71	0.80	0.68	0.71

Figure 31: Monthly crude oil production in 2022, million barrels

Source: Petroleum Commission (PC)

In 2022, 30.52 million barrels of crude oil were produced from the Jubilee field, down from 27.34 million barrels in 2021. The Jubilee field recorded its highest and minimum production in March and May respectively. The reduced production in May 2022 was due to planned shutdown activities carried out on the facility from 30th April to 14th May 2022.

TEN fields produced 8.61 million barrels of crude oil in 2022, lower than the 11.98 million barrels produced in 2021. The field recorded its lowest oil production in August and highest production in October. The decline in production was attributed to factors such as flow assurance issues, inadequate pressure support, challenges in water injection, and increasing Gas-Oil Ratio, among others.

Production from the Sankofa field reduced by 19.8% in 2022, with 12.62 million barrels of crude oil produced.

The field's highest and lowest monthly production was in January and February respectively. The decline in production was due to the activation of emergency shutdowns among other issues[5].

Average daily production from the three fields combined was lower in 2022 compared to 2021. Average production per day reduced from 150,841 barrels in 2021 to 141,881 barrels in 2022, representing a decline of 5.9%. This also witnessed a reduction of 3.0% from the projected average daily production for 2022[6] (Figure 31).

The average daily production from Jubilee Field in 2022 was 83,719 barrels compared to 81,158 barrels in 2021, representing an increase of 11.8%. Average daily production from the TEN fields reduced from 32,844 barrels in 2021 to 23,597 barrels in 2022. Production from the Sankofa field also reduced from an average of 43,138 barrels per day in 2021 to 34,566 barrels per day in 2022. As observed in Figure 31, the Jubilee field exceeded its projected production for 2022, while TEN and Sankofa fell short of their anticipated production.

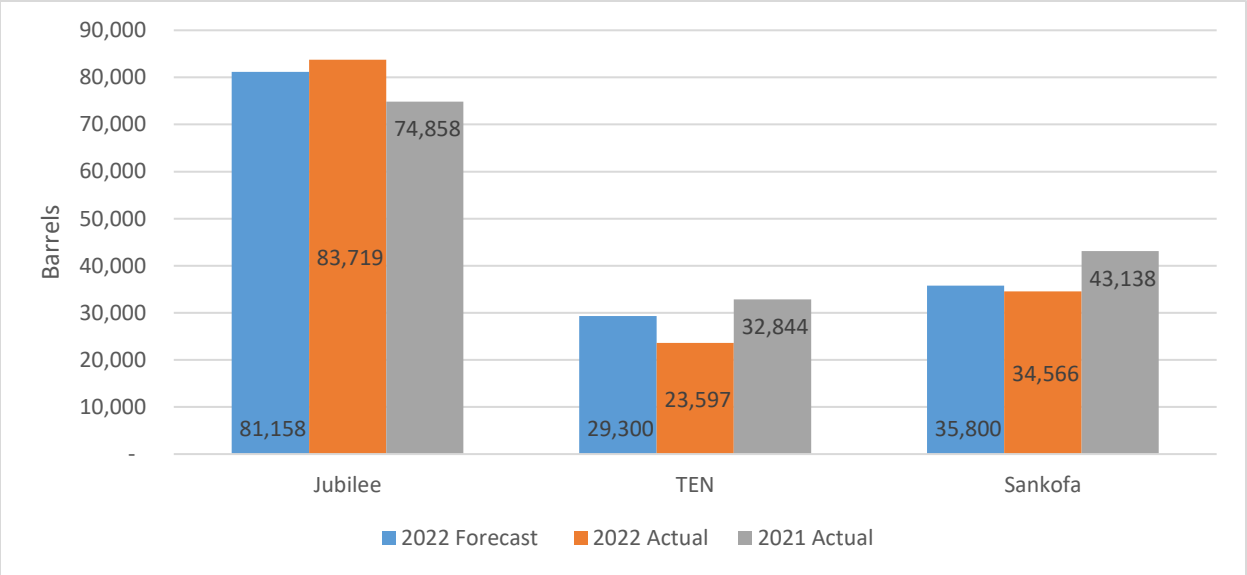
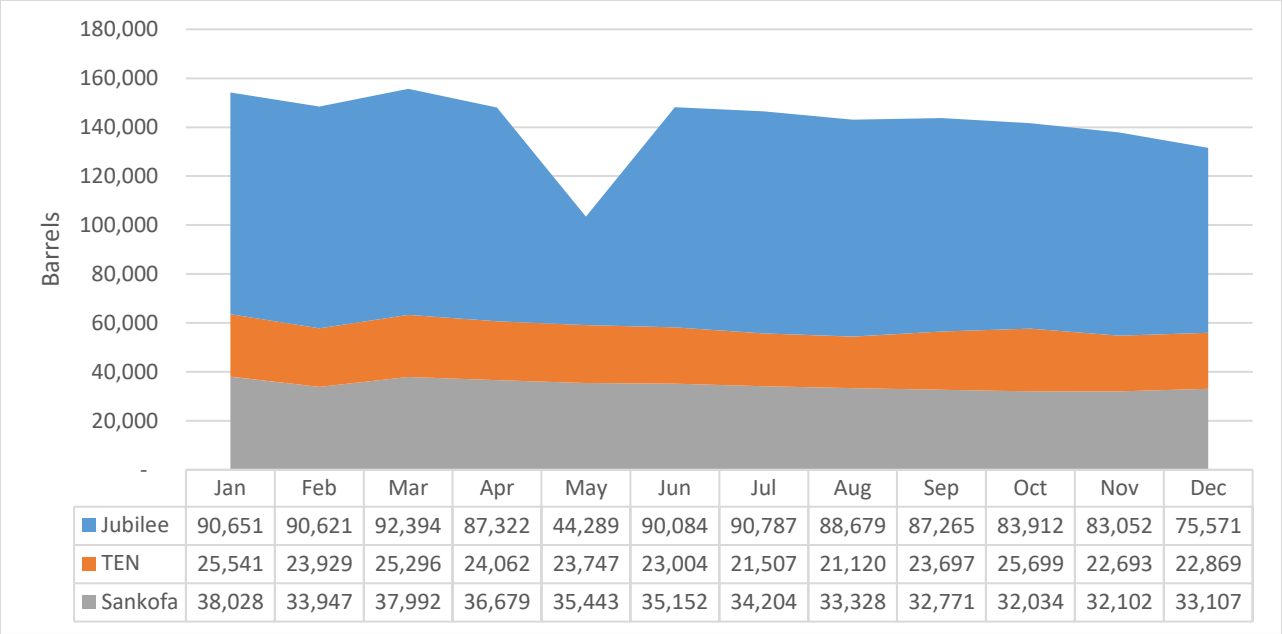


Figure 32: Actual and projected average daily production of crude oil

[5] Public Interest and Accountability Committee (PIAC): https://www.piacghana.org/portal/files/downloads/piac_reports/piac_2022_annual_report.pdf

[6] 2022 Energy (Supply and Demand) Outlook for Ghana: http://energycom.gov.gh/planning/data-center/energy-outlook-for-ghanalo



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jubilee	90,651	90,621	92,394	87,322	44,289	90,084	90,787	88,679	87,265	83,912	83,052	75,571
TEN	25,541	23,929	25,296	24,062	23,747	23,004	21,507	21,120	23,697	25,699	22,693	22,869
Sankofa	38,028	33,947	37,992	36,679	35,443	35,152	34,204	33,328	32,771	32,034	32,102	33,107

Figure 33: Monthly average daily volumes of crude oil production in 2022

Source: PC

4.1.2 Crude Oil Import

The country relies on imported crude oil for the production of petroleum products and electricity generation. Total crude oil imported in 2022 was 216,201 barrels, a decrease of 57.9% of import in 2021. All the crude oil imported in the year under review was by the privately-owned refineries, as no crude oil was imported for electricity generation. Figure 33 presents monthly volumes of crude oil imported into the country in 2022.

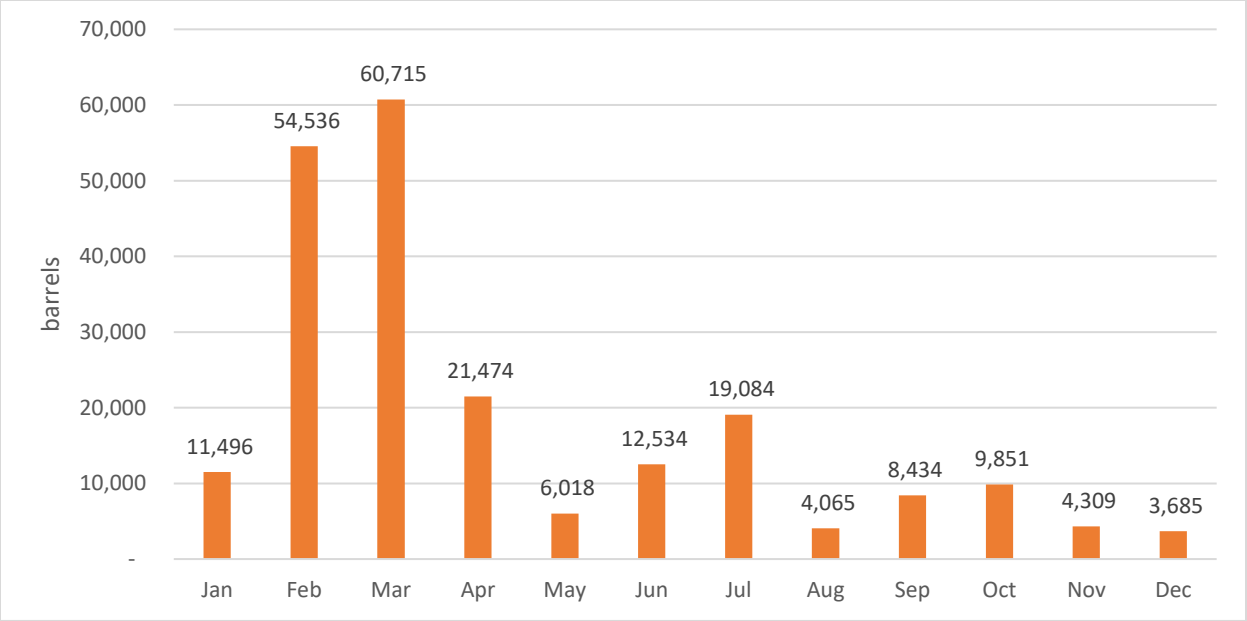


Figure 34: Monthly crude oil imported into the country in 2022

Source: NPA

4.1.3 Crude Oil Price

The average price of Brent crude in 2022 was US$100.78 per barrel. This represents a 42.3% increase in the average price recorded in 2021, and 34.4% higher than projected for the year. The price of US WTI averaged US$94.79 per barrel in 2022, which is about 30.1% higher than the average price in 2021 and 32.8% higher than projected for the year. Figure 34 depicts average monthly crude oil prices for the two international reference crude oil over the last two decades.

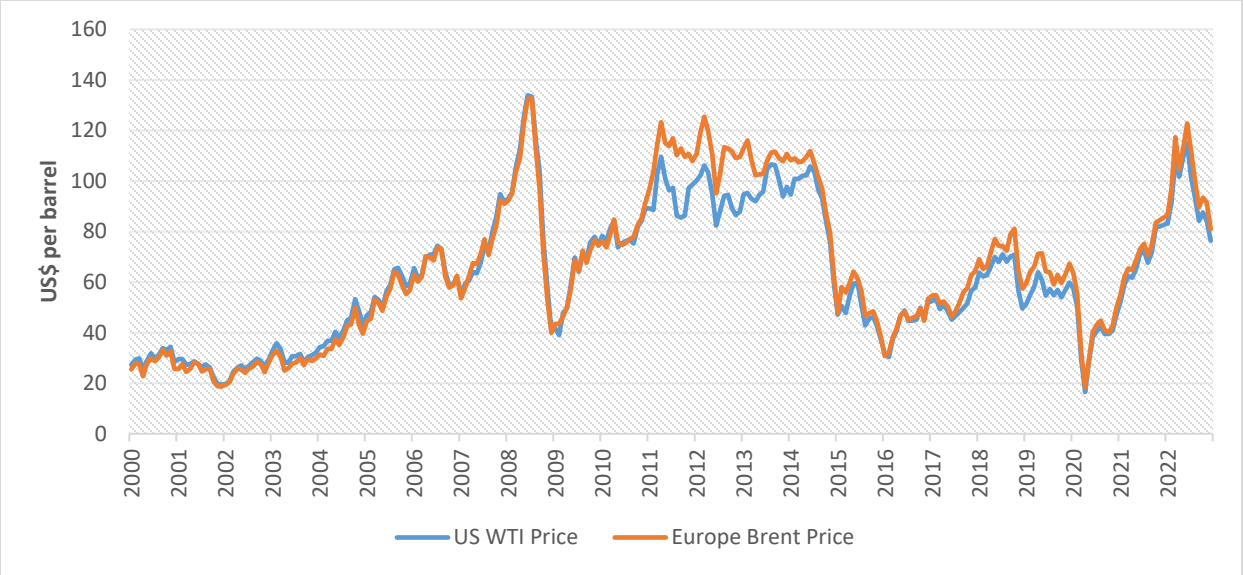


Figure 35: Average crude oil prices for US WTI and Europe Brent 2001-2022

Source: US Energy Information Administration

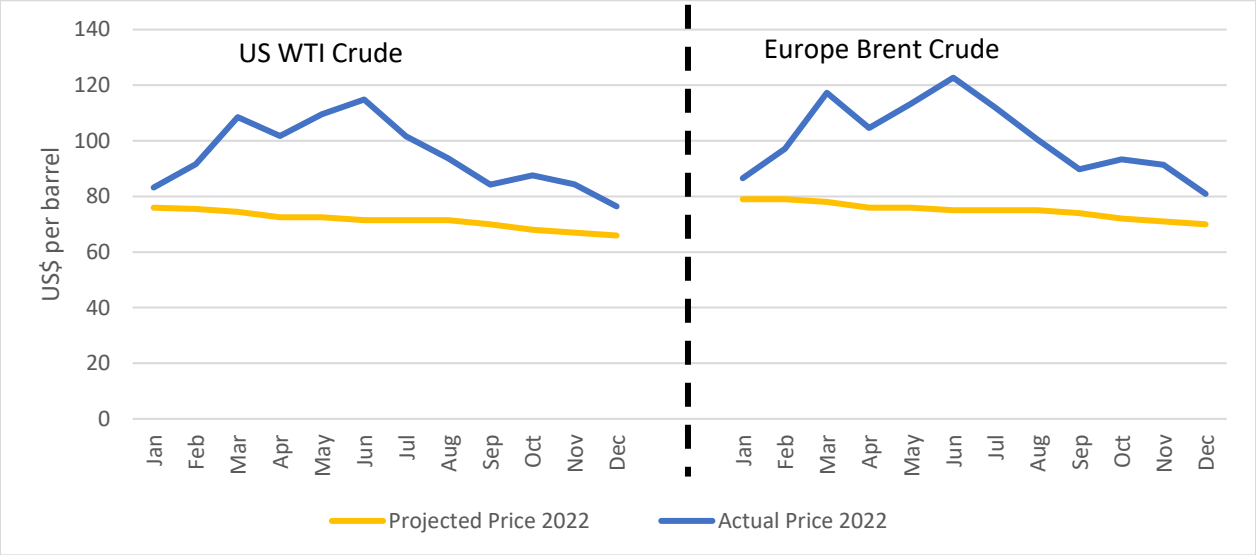


Figure 36: Monthly international average crude oil prices in 2022, US$ per barrel

Source: US Energy Information Administration

Ghana continues to export its crude oil produced from the three oil-producing fields. In 2022, the average price achieved by Ghana Group was US$105.74 per barrel, an increase from the average price achieved of US$69.18 per barrel in 2021.

The achieved unit price was slightly higher than the international Brent average price of US$105.09 per barrel for the same lifting dates in 2022 for the three fields. Table 5 presents the achieved prices of Jubilee, TEN and Sankofa fields in 2022.

Table 5: Achieved market price of Ghana Group oil liftings in 2022, US$/barrel

Field	Date Lift	Ghana Group Achieved Price	International Price (Europe Brent)
Jubilee	01-Feb-22	97.01	95.32
	26-Mar-22	115.19	112.68
	12-Jun-22	126.34	123.70
	04-Aug-22	102.24	99.99
	27-Sep-22	87.41	87.30
	17-Dec-22	79.03	80.04
	Average	**101.20**	**99.84**
TEN	20-Jul-22	111.92	109.92
	Average	**111.92**	**109.92**
Sankofa	06-Mar-22	120.41	118.81
	26-Apr-22	102.79	104.39
	07-Oct-22	89.14	93.33
	Average	**104.11**	**105.51**

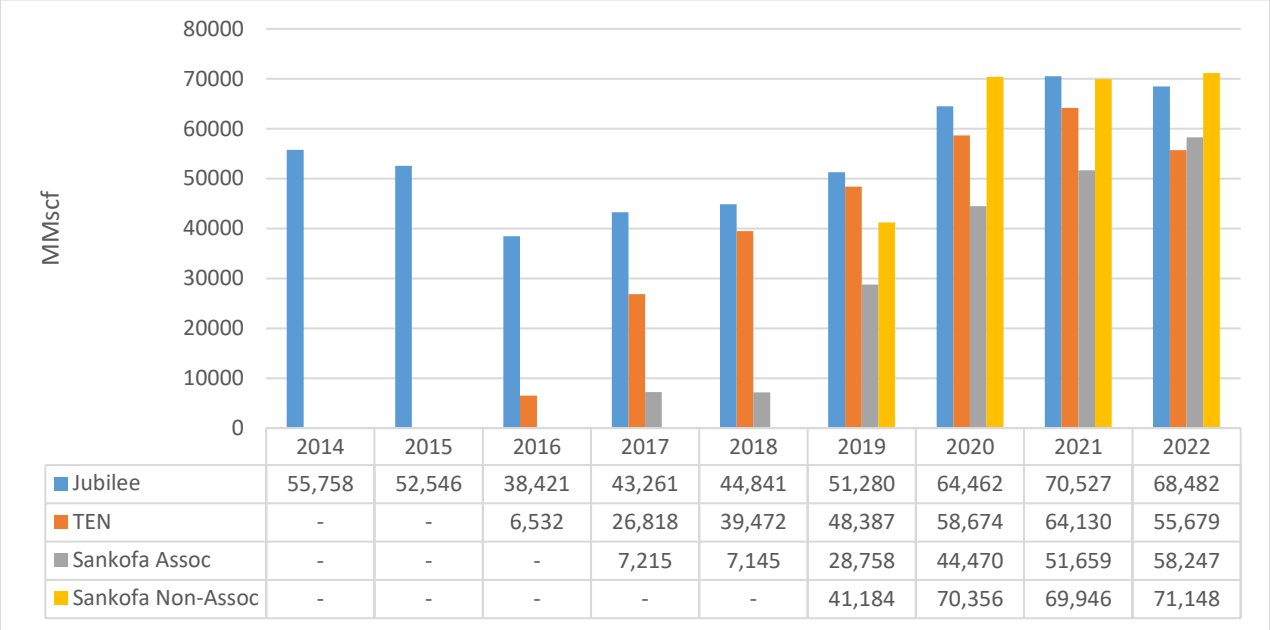
Source: GNPC

The average price achieved by Ghana Group for five liftings at the Jubilee field in 2022 was US$101.20 per barrel compared to US$69.75 per barrel for six liftings in 2021. The unit price achieved was slightly higher than the international Brent average price of US$99.84 per barrel for the same lifting dates in 2022. For the TEN fields, the average price achieved was US$111.92 per barrel for one lift in 2022, which is higher than the average price of US$69.11 per barrel achieved for three liftings in 2021. The unit price achieved for the TEN field was higher than the Brent average price of US$109.92 per barrel for the same lifting date in 2022. There were three liftings at the Sankofa field for an achieved average price of US$104.11 per barrel in 2022, up from US$68.79 per barrel for two liftings in 2021. The achieved unit price for the Sankofa field was a bit lower than the international Brent average price of US$105.51 per barrel for the same lifting dates in 2022.

4.2 Natural Gas

4.2.1 Natural Gas Production

Natural gas produced (both associated and non-associated) from the three fields – Jubilee, TEN and Sankofa in 2022 was 253,555 MMscf. This represents a 1.1% decrease over the volume of 256,262 MMscf produced in 2021. The decrease in production is attributed to reduced production from the Jubilee and TEN fields. Figure 36 presents the volumes of raw gas produced since 2014.

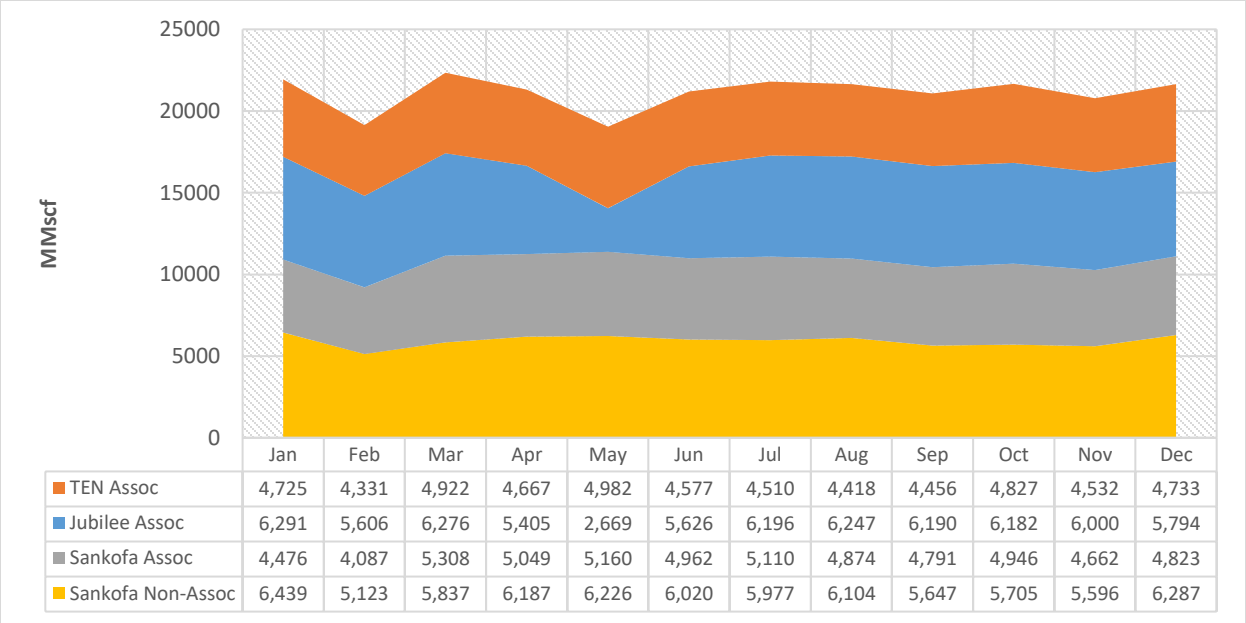


	2014	2015	2016	2017	2018	2019	2020	2021	2022
Jubilee	55,758	52,546	38,421	43,261	44,841	51,280	64,462	70,527	68,482
TEN	-	-	6,532	26,818	39,472	48,387	58,674	64,130	55,679
Sankofa Assoc	-	-	-	7,215	7,145	28,758	44,470	51,659	58,247
Sankofa Non-Assoc	-	-	-	-	-	41,184	70,356	69,946	71,148

Figure 37: Volumes of raw gas production from 2014 to 2022

Source: GNPC and PC

Raw gas produced from the Jubilee field in 2022 decreased by 2.9%, from 70,527 MMscf in 2021. TEN fields also witnessed a 13.2% decrease in production, from 64,130 MMscf produced in 2021. Total raw gas production from the Sankofa field was 129,395 MMscf in 2022, up from 121,605 MMscf produced in 2021. This is made up of 45.0% of associated gas and 55.0% of non-associated gas. Figure 37 presents the monthly production of raw gas for the three producing fields in 2022.

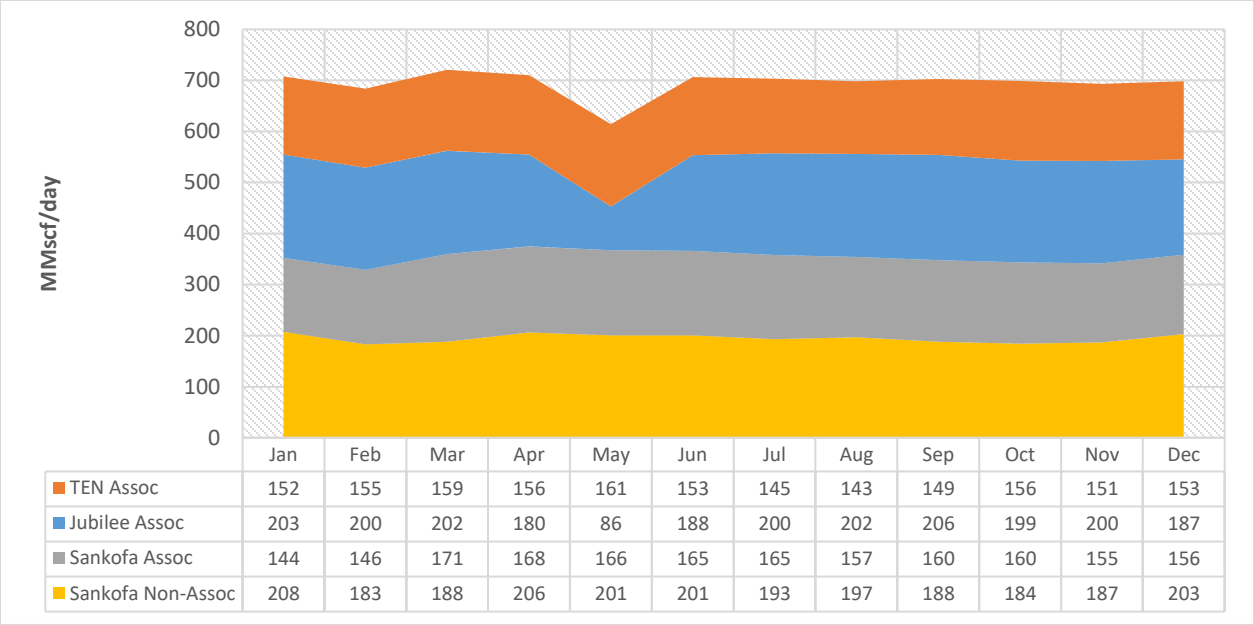


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEN Assoc	4,725	4,331	4,922	4,667	4,982	4,577	4,510	4,418	4,456	4,827	4,532	4,733
Jubilee Assoc	6,291	5,606	6,276	5,405	2,669	5,626	6,196	6,247	6,190	6,182	6,000	5,794
Sankofa Assoc	4,476	4,087	5,308	5,049	5,160	4,962	5,110	4,874	4,791	4,946	4,662	4,823
Sankofa Non-Assoc	6,439	5,123	5,837	6,187	6,226	6,020	5,977	6,104	5,647	5,705	5,596	6,287

Figure 38: Monthly raw gas production in 2022

Source: PC

Daily production of raw gas from the Jubilee field in 2022 was 188 MMscf/day, down from 193 MMscf/day in 2021. Average daily production from the TEN fields also decreased from 177 MMscf/day in 2021 to 153 MMscf/day in 2022. Jubilee and TEN combined achieved an average production of 340 MMscf/day in 2022. Daily average production from the Sankofa field (both associated and non-associated) increased to 354 MMscf/day in 2022 from 332 MMscf/day in 2021. In all, the average daily production of raw gas from the three fields combined in 2022 was 695 MMscf/day, a decrease of 1.0% over 2021 average daily production. Figure 38 presents the monthly average daily production of raw gas from the producing fields in the year under review.



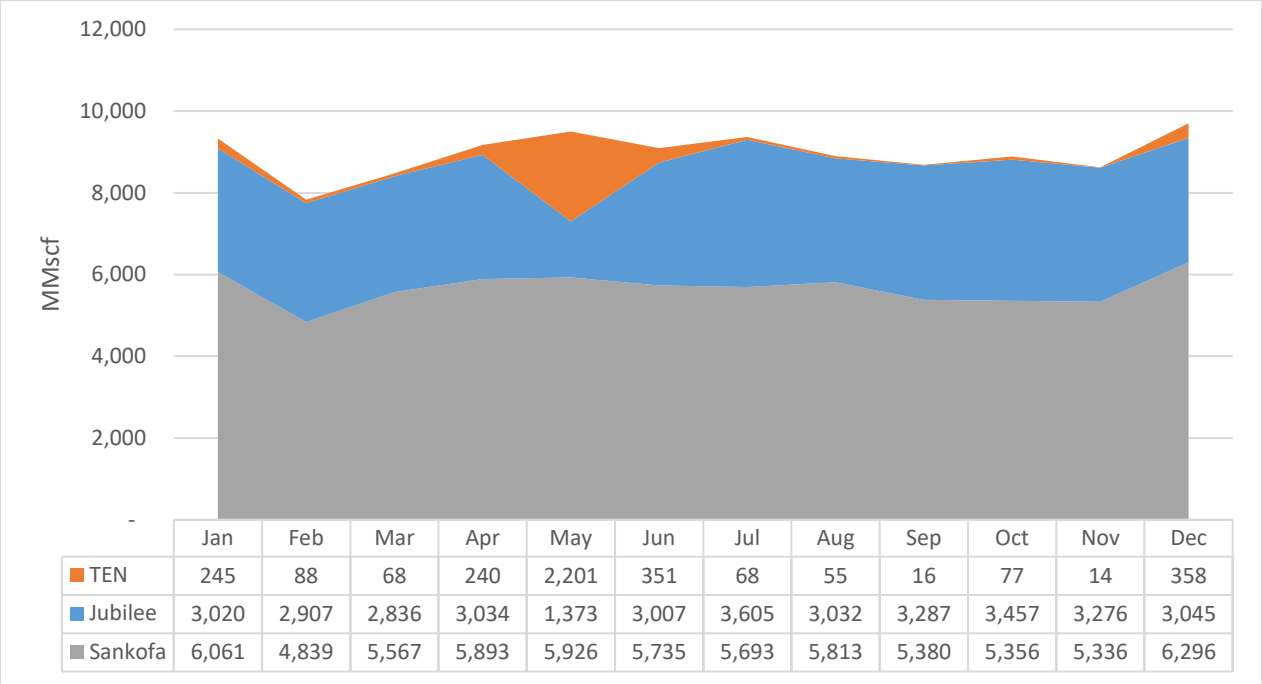
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEN Assoc	152	155	159	156	161	153	145	143	149	156	151	153
Jubilee Assoc	203	200	202	180	86	188	200	202	206	199	200	187
Sankofa Assoc	144	146	171	168	166	165	165	157	160	160	155	156
Sankofa Non-Assoc	208	183	188	206	201	201	193	197	188	184	187	203

Figure 39: Monthly average daily volumes of natural gas produced in 2022

Source: GNPC

4.2.2 Gas Export from Producing Fields

Total raw gas exported from Jubilee (associated gas) to Atuabo Gas Processing Plant (AGPP) and from Sankofa (non-associated gas) to the ENI Offshore Receiving Facility (ENI ORF) witnessed a significant increase in 2022. However, gas export from TEN (associated gas) to the AGPP witnessed a considerable reduction in the year under review. A total of 107,560 MMscf of associated and non-associated gas was exported in 2022, an increase of 8.8% over the 2021 volume of 98,901 MMscf. Figure 39 presents the monthly gas export from the three fields in 2022.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEN	245	88	68	240	2,201	351	68	55	16	77	14	358
Jubilee	3,020	2,907	2,836	3,034	1,373	3,007	3,605	3,032	3,287	3,457	3,276	3,045
Sankofa	6,061	4,839	5,567	5,893	5,926	5,735	5,693	5,813	5,380	5,356	5,336	6,296

Figure 40: Monthly raw gas exported from Jubilee, TEN and Sankofa in 2022

Source: PC

AGPP continues to receive a steady supply of raw gas from the Jubilee field. The field exported 35,881 MMscf of raw gas to AGPP in 2022, representing 52.4% of gas produced, with the remainder re-injected, used as fuel or flared. The raw gas exported was 15.8% higher than that of 2021 (30,998 MMscf). The increase in export was attributed to a substantial increase in gas offtake in 2022.

There was also a significant increase in raw gas supplied from the TEN fields to the AGPP in 2022. The fields exported 3,783 MMscf to the AGPP in 2022, up from 2,761 MMscf exported in 2021. A greater portion of raw gas produced from the TEN fields (93.2%) was either re-injected, used as fuel on the FPSO or flared. The treatment of the associated gas from the Jubilee field as a foundation gas under a substitution agreement might have accounted for the low export.

Sankofa field exported 67,896 MMscf, representing 95.4% of the non-associated gas exported to the ORF in 2022.

This represents a 4.2% increase over the volumes exported in 2021 (65,141 MMscf). The remaining volume of gas produced on the field was re-injected, flared or used for electricity generation on the FPSO.

The average daily export of gas from the three fields combined was 295 MMscf/day, an increase of 8.3% over 2021 average daily export, but a decrease of 12.1% from what was projected for the year (Figure 40)[7]. Figure 41 presents the monthly average daily export of gas from the three fields in 2022.

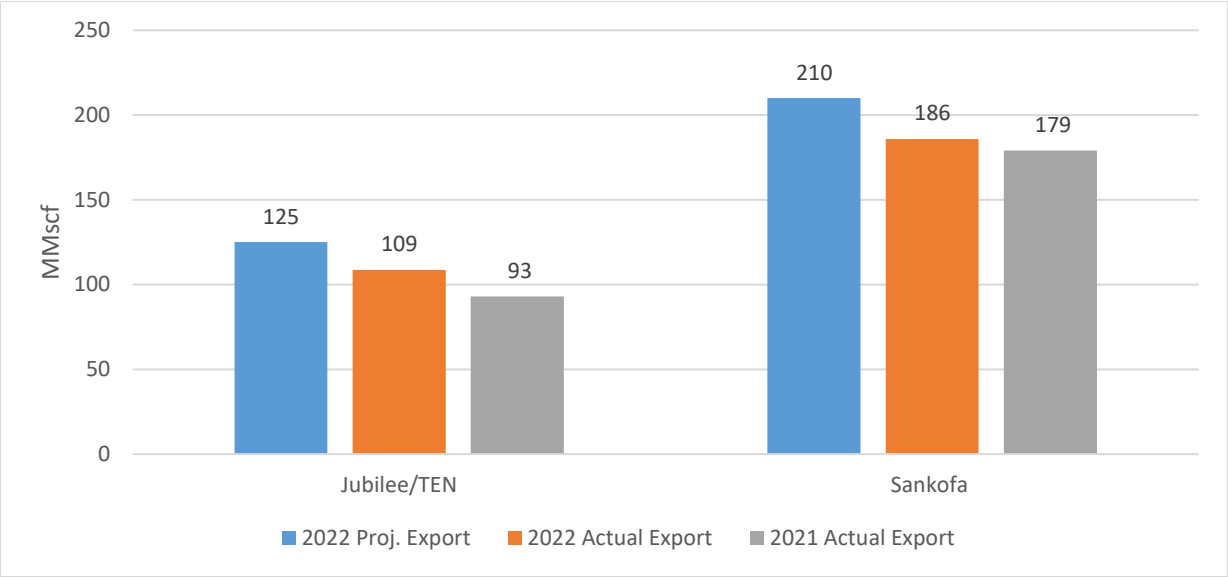
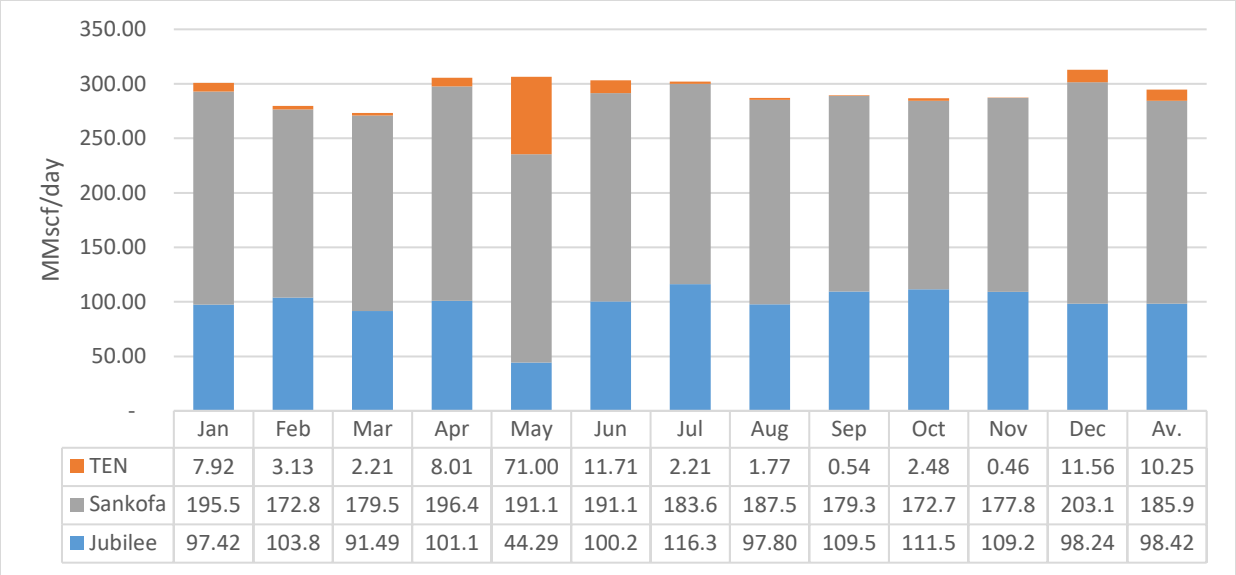


Figure 41: Projected and actual average daily gas exported from the three fields in 2022

[7] 2022 Energy (Supply and Demand) Outlook for Ghana: http://energycom.gov.gh/planning/data-center/energy-outlook-for-ghana



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
TEN	7.92	3.13	2.21	8.01	71.00	11.71	2.21	1.77	0.54	2.48	0.46	11.56	10.25
Sankofa	195.5	172.8	179.5	196.4	191.1	191.1	183.6	187.5	179.3	172.7	177.8	203.1	185.9
Jubilee	97.42	103.8	91.49	101.1	44.29	100.2	116.3	97.80	109.5	111.5	109.2	98.24	98.42

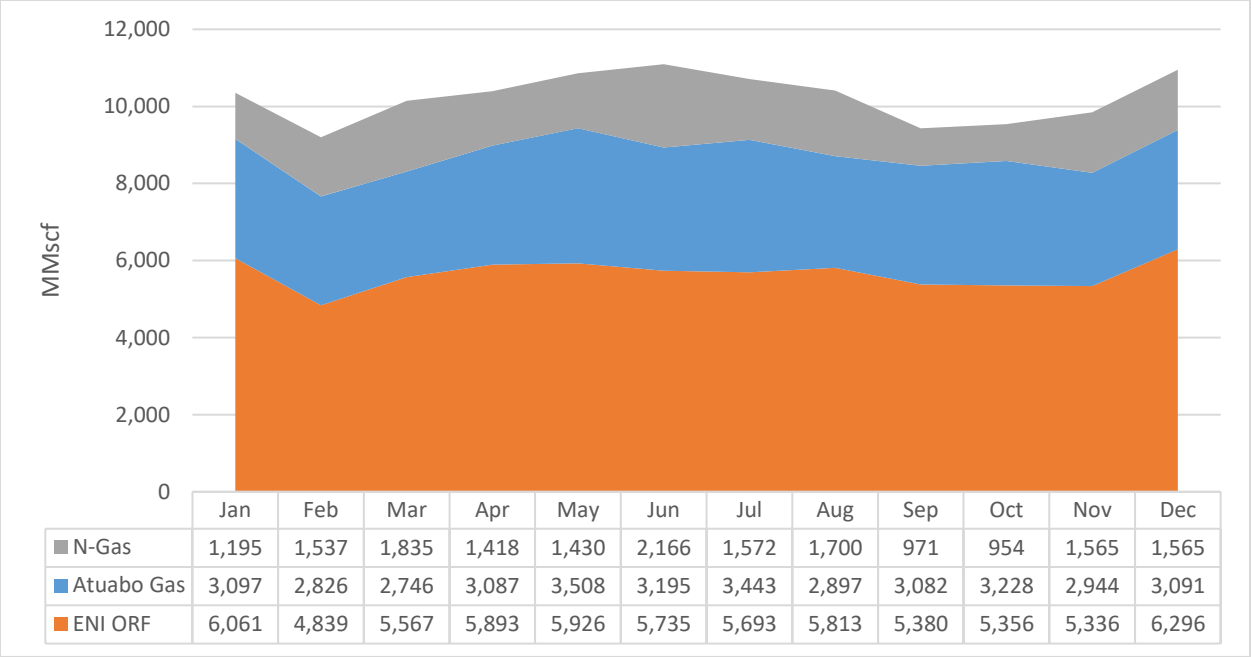
Figure 42: Monthly average daily export of gas from the three fields in 2022

Source: PC

Daily export of raw gas from the Jubilee field in 2022 was 98 MMscf/day, up from 85 MMscf/day in 2021. The average daily export from the TEN fields increased from 8 MMscf/day in 2021 to 10 MMscf/day in 2022. The average daily export from both Jubilee and TEN was 109 MMscf/day, which was lower than the average daily export of 125 MMscf/day projected in 2022. Gas exported from Jubilee/TEN was 17.4% higher than volumes exported in 2021. Daily average export from the Sankofa fields (non-associated) increased to 186 MMscf/day in 2022 from 179 MMscf/day in 2021.

4.2.3 Lean Gas Supplied in 2022

Total lean gas supplied from three main sources - AGPP, ENI ORF and Nigeria rose to 122,947 MMscf in 2022, from 115,503 MMscf in 2021. The total lean gas is made up of 37,143 MMscf supplied by AGPP from processing raw gas exported from Jubilee and TEN fields and 67,897 MMscf of non-associated gas received at the ENI ORF. The remaining 17,908 MMscf was imported from Nigeria via WAGPCo. The increase in the supply of lean gas in 2022 was a result of an increase in offtake for electricity generation and an appreciable increase in demand for non-power purposes. Monthly supplies of lean gas from the three sources are presented in Figure 42.

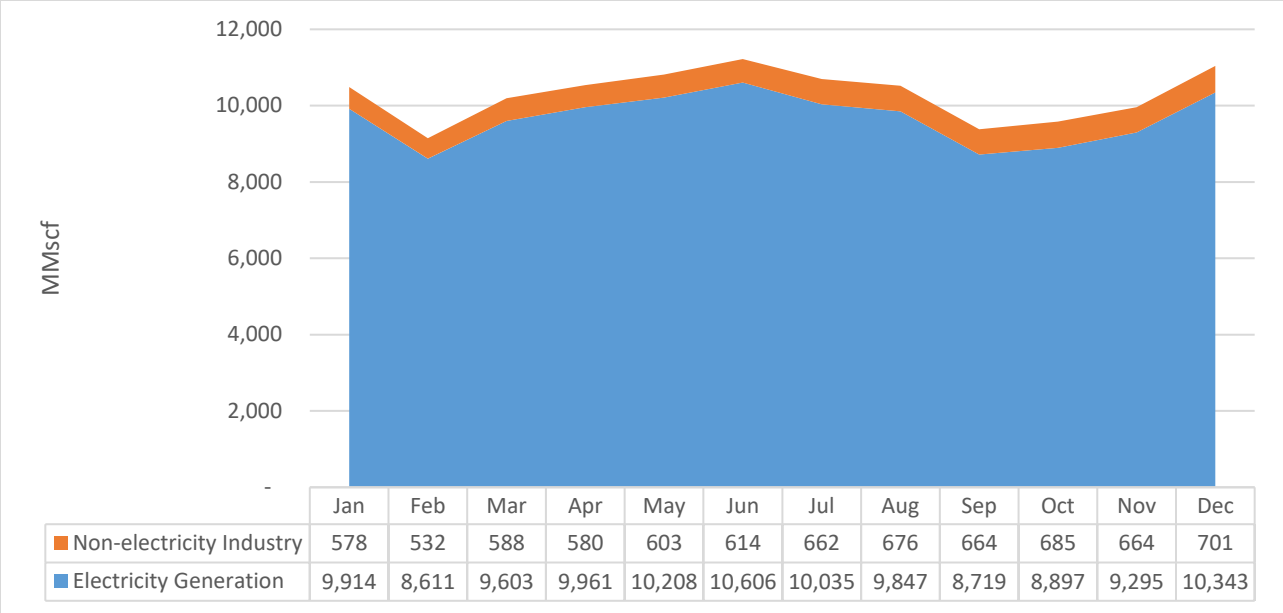


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
N-Gas	1,195	1,537	1,835	1,418	1,430	2,166	1,572	1,700	971	954	1,565	1,565
Atuabo Gas	3,097	2,826	2,746	3,087	3,508	3,195	3,443	2,897	3,082	3,228	2,944	3,091
ENI ORF	6,061	4,839	5,567	5,893	5,926	5,735	5,693	5,813	5,380	5,356	5,336	6,296

Figure 43: Monthly lean gas supplied by AGPP, ENI ORF and WAGPCo

Source: GNGC, VRA

In terms of industrial share, a large portion (93.9%) of gas supplied in 2022 was used to generate electricity, with the remaining 6.1% used for non-power activities (industrial uses), mainly in the ceramics industry.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Non-electricity Industry	578	532	588	580	603	614	662	676	664	685	664	701
Electricity Generation	9,914	8,611	9,603	9,961	10,208	10,606	10,035	9,847	8,719	8,897	9,295	10,343

Figure 44: Monthly lean gas supplied

Source: GNGC, VRA

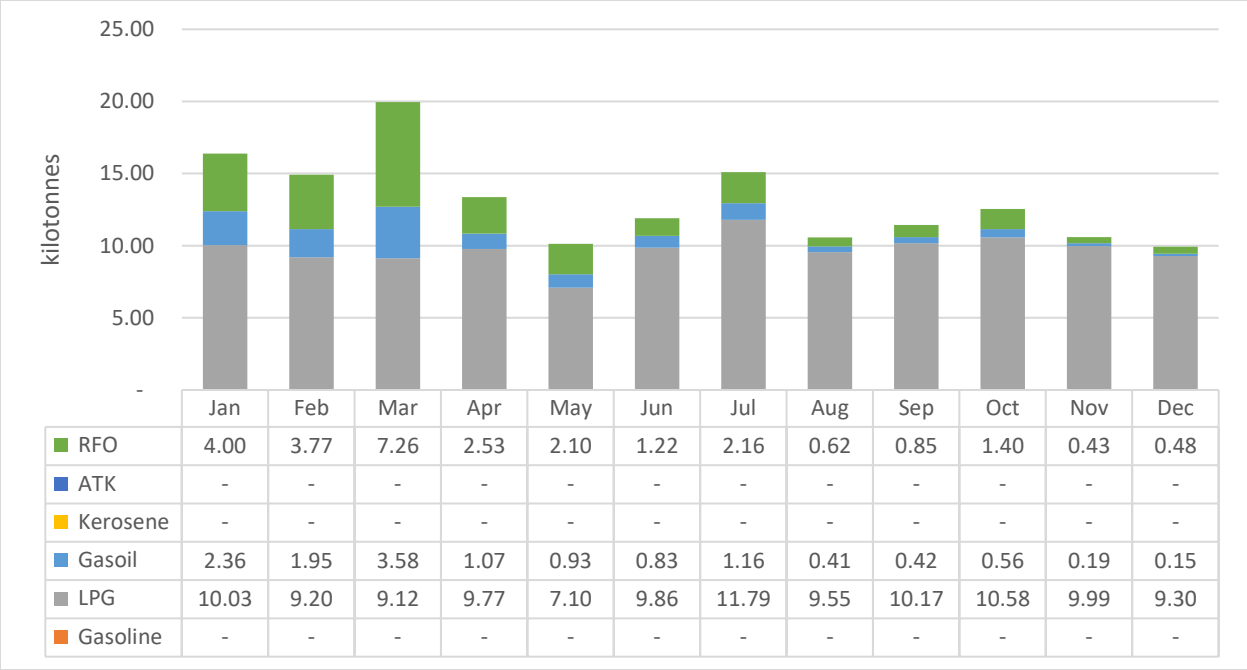
Total gas supplied for power generation increased to 116,039 MMscf, from 109,768 MMscf in 2021. The total supply for industrial uses in 2022 was 7,547 MMscf, up from 5,735 MMscf in 2021.

4.3 Petroleum Product

4.3.1 Petroleum Products Production

Total petroleum products produced[8] reduced from 378 kilotonnes in 2021 to 157 kilotonnes in 2022. The reduction may be due to challenges in securing the necessary financing to procure crude oil for the state-owned Tema Oil Refinery (TOR). In 2022, only the privately-owned refineries (i.e. Platon Gas Oil and Akwaaba Oil Refinery) and GNGC operated. Figure 44 presents the monthly quantities of petroleum products refined in 2022.

[8] Currently, there are three refineries that process crude oil into the various petroleum products in the country. these are the state-owned Tema Oil Refinery (TOR) and two privately owned refineries namely Platon Gas Oil Limited and Akwaaba Oil Limited



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RFO	4.00	3.77	7.26	2.53	2.10	1.22	2.16	0.62	0.85	1.40	0.43	0.48
ATK	-	-	-	-	-	-	-	-	-	-	-	-
Kerosene	-	-	-	-	-	-	-	-	-	-	-	-
Gasoil	2.36	1.95	3.58	1.07	0.93	0.83	1.16	0.41	0.42	0.56	0.19	0.15
LPG	10.03	9.20	9.12	9.77	7.10	9.86	11.79	9.55	10.17	10.58	9.99	9.30
Gasoline	-	-	-	-	-	-	-	-	-	-	-	-

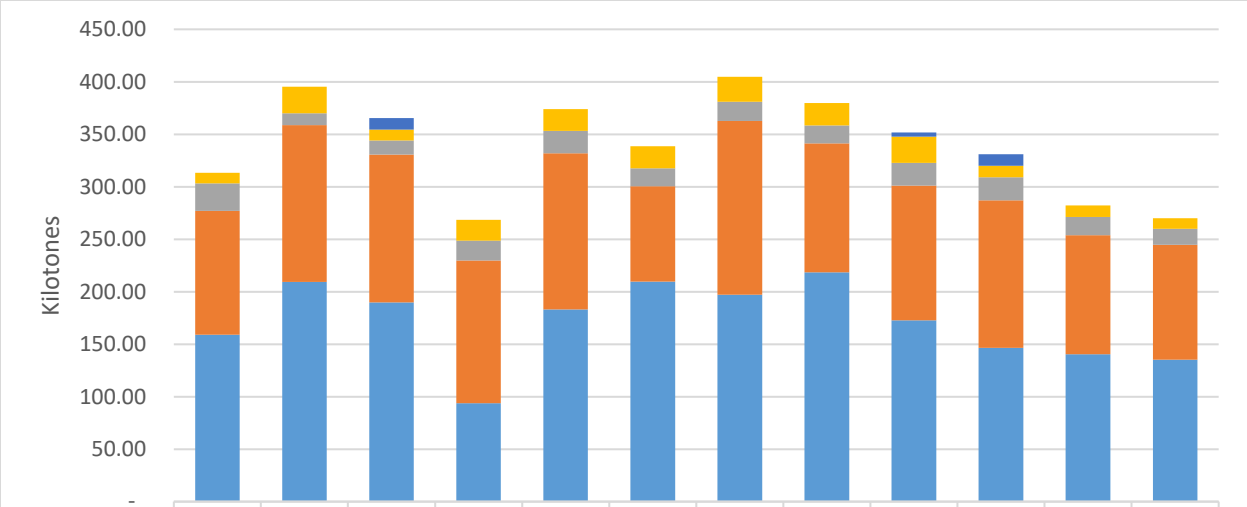
Figure 45: Petroleum products produced in the country in 2022

Source: NPA, GNGC

Gasoil (diesel) production witnessed a drastic decline to 14 kilotonnes in 2022, representing an 80.6% decrease from 2021 production. About 116 kilotonnes (100% produced by GNGC) of liquefied petroleum gas (LPG) was produced in 2022 as against 95. kilotonnes produced in 2021. Residual Fuel Oil (RFO) produced was 27 kilotonnes in 2022, down from 145 kilotonnes produced in 2021.

4.3.2 Petroleum Product Import

Total imports decreased by 1.2%, from 4,126 kilotonnes in 2021 to 4,075 kilotonnes in 2022. Figure 45 presents monthly quantities of various petroleum products imported into the country in 2022.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RFO	-	-	11.04	-	-	-	-	-	4.00	10.98	-	-
ATK	9.96	25.27	10.48	19.91	20.71	20.96	23.77	21.34	24.96	10.96	10.96	9.94
LPG	26.19	11.31	13.19	18.93	21.57	17.27	18.36	17.19	21.65	21.98	17.49	15.38
Gasoline	117.93	149.30	141.05	136.02	148.57	90.90	165.71	122.86	128.34	140.54	113.40	109.25
Gasoil	159.07	209.45	189.76	93.63	183.21	209.52	197.01	218.35	172.77	146.54	140.42	135.39

Figure 46: Monthly quantity of petroleum products imported into the country in 2022

Source: NPA

Gasoil import increased to 2,055 kilotonnes, representing a 12.9% increase over quantities imported in 2022. Gasoline and LPG on the other hand recorded a decrease in import, from 1,564 kilotonnes and 221 Kilotonnes respectively in 2021 to 1,769 kilotonnes and 263 kilotonnes in 2022. ATK witnessed an increase in imports, from 188 kilotonnes in 2021 to 209 kilotonnes in 2022. RFO, for the first time in many years, witnessed an import of 26 kilotonnes in 2022.

4.3.3 Petroleum Product Consumption

In 2022, a total of 4,214 kilotonnes of petroleum products were consumed in the country. The consumption represents a decrease of some 7.3% from 2021 quantities and a 14.6% decrease in projected consumption for the year[9]. For the first time in five years, petroleum product consumption witnessed a decline, which could be attributed to economic downtime (Figure 46).

[9]2022 Energy (Supply and Demand) Outlook for Ghana: http://energycom.gov.gh/planning/data-center/energy-outlook-for-ghana

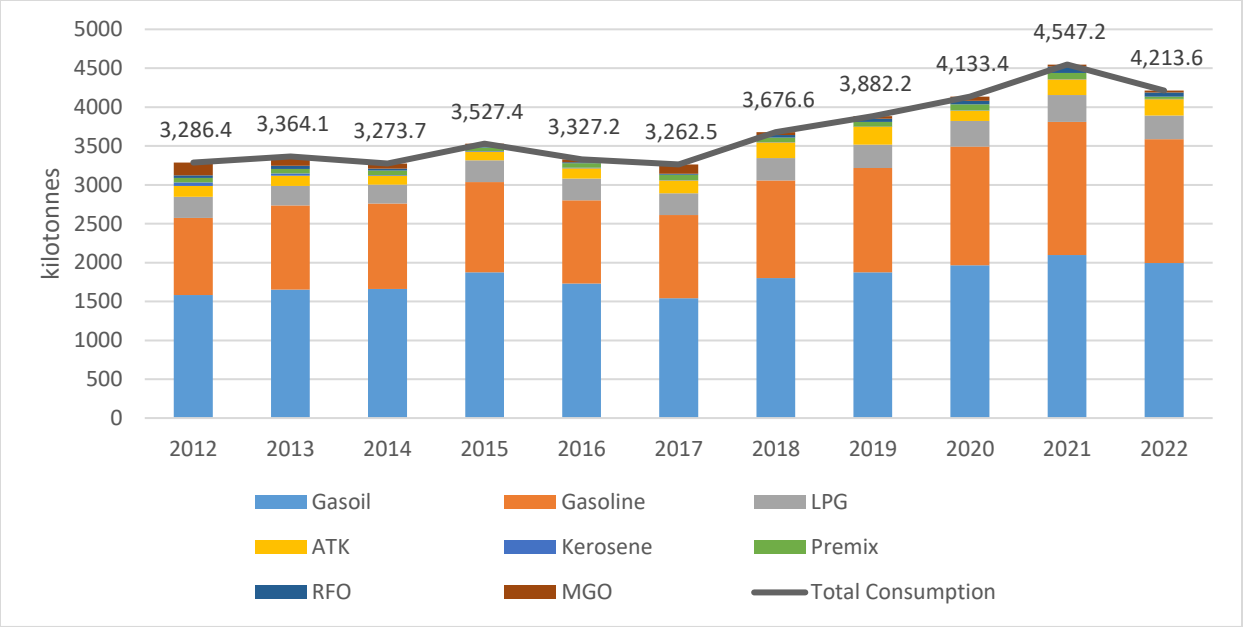
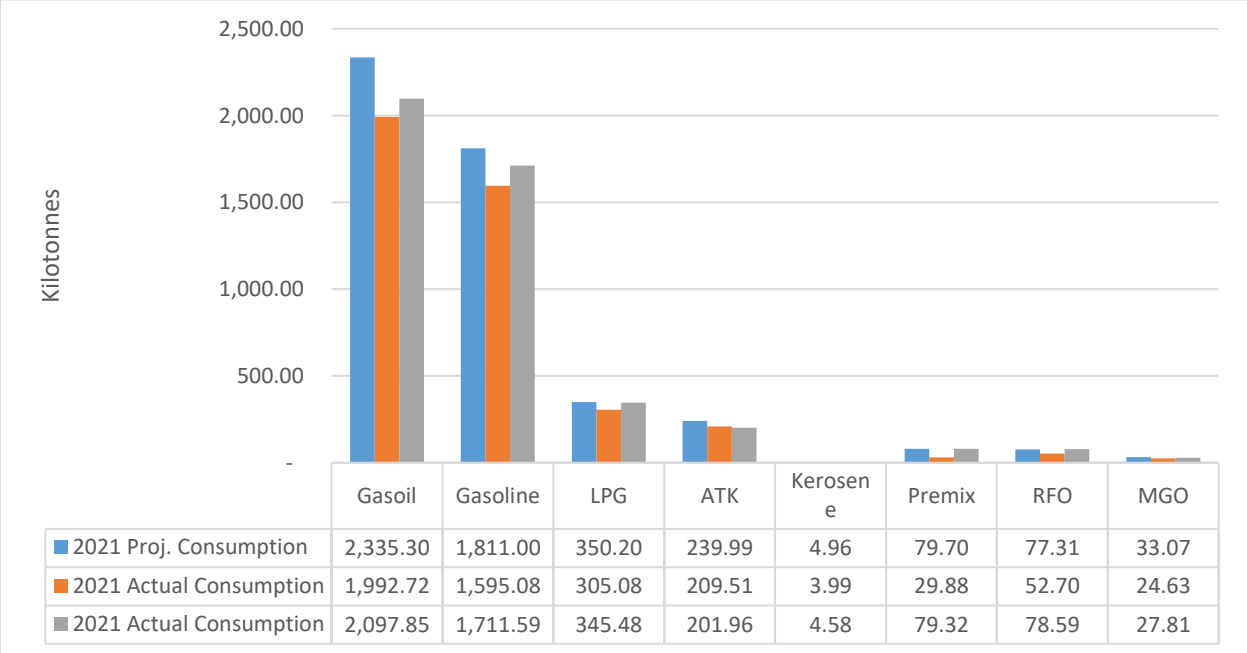


Figure 47: Trend in petroleum products consumption from 2012-2022

Source: NPA

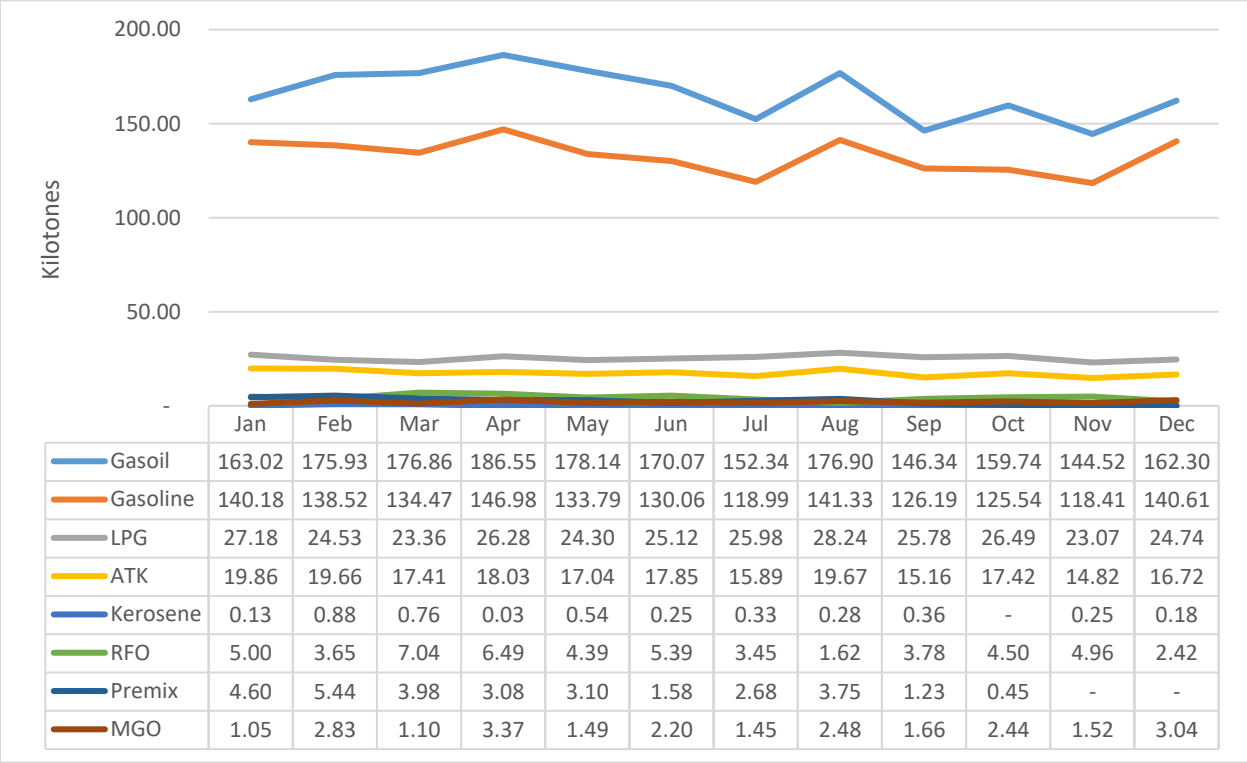


	Gasoil	Gasoline	LPG	ATK	Kerosene	Premix	RFO	MGO
2021 Proj. Consumption	2,335.30	1,811.00	350.20	239.99	4.96	79.70	77.31	33.07
2021 Actual Consumption	1,992.72	1,595.08	305.08	209.51	3.99	29.88	52.70	24.63
2021 Actual Consumption	2,097.85	1,711.59	345.48	201.96	4.58	79.32	78.59	27.81

Figure 48: Projected versus actual consumption of major petroleum products in 2022

About 1,993 kilotonnes of Gasoil was consumed in 2022, a decrease of 5.0% over consumption in 2021, and a 14.7% decrease in the quantities projected for the year.

Similarly, gasoline also recorded a decrease in consumption from 1,712 kilotonnes in 2021 to 1595 kilotonnes in 2022. The consumption of gasoline was 11.9% less than the 1,811 kilotonnes projected for the year. (Figure 47). LPG, kerosene, premix, RFO and MGO consumptions also decreased by 11.7%, 13.0%, 62.3%, 33.0% and 11.5% respectively from their 2021 consumptions level. However, ATK consumption increased by 3.7%, from 202 kilotonnes in 2021 to 210 kilotonnes in 2022. Figure 48 depicts the trend in monthly petroleum product consumption in 2022.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gasoil	163.02	175.93	176.86	186.55	178.14	170.07	152.34	176.90	146.34	159.74	144.52	162.30
Gasoline	140.18	138.52	134.47	146.98	133.79	130.06	118.99	141.33	126.19	125.54	118.41	140.61
LPG	27.18	24.53	23.36	26.28	24.30	25.12	25.98	28.24	25.78	26.49	23.07	24.74
ATK	19.86	19.66	17.41	18.03	17.04	17.85	15.89	19.67	15.16	17.42	14.82	16.72
Kerosene	0.13	0.88	0.76	0.03	0.54	0.25	0.33	0.28	0.36	-	0.25	0.18
RFO	5.00	3.65	7.04	6.49	4.39	5.39	3.45	1.62	3.78	4.50	4.96	2.42
Premix	4.60	5.44	3.98	3.08	3.10	1.58	2.68	3.75	1.23	0.45	-	-
MGO	1.05	2.83	1.10	3.37	1.49	2.20	1.45	2.48	1.66	2.44	1.52	3.04

Figure 49: Monthly consumption of petroleum products in 2022

Source: NPA

4.3.4 Petroleum Product Prices

Figure 49 shows the bi-weekly price of some major petroleum products. The price of gasoline averaged GH¢10.87 per litre in 2022, up by 87.9% from the 2021 average price of GH¢5.81 per litre. Gasoil price, which follows a similar trend averaged GH¢12.87 per litre in 2022, witnessing an increase of 120% from the 2021 average price of GH¢5.85 per litre.

The price of LPG averaged GH¢11.10 per kilogram in 2022, an increase of 63.0% from the 2021 average price of GH¢6.81 per kilogram.

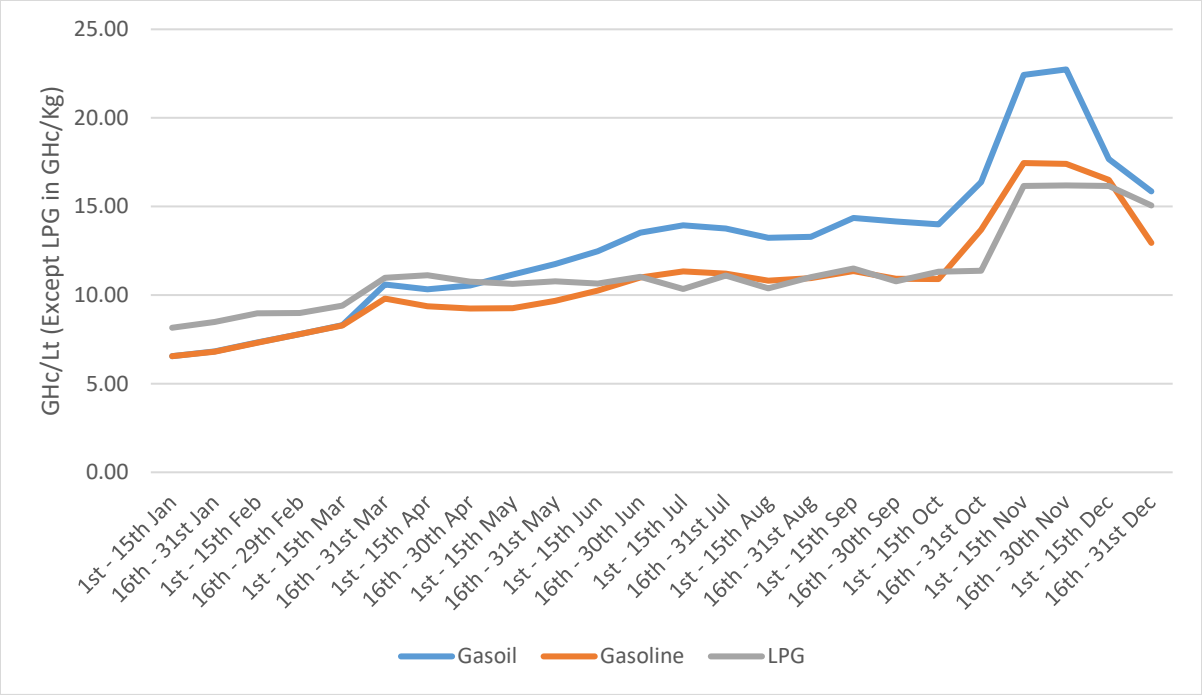


Figure 50: Trend in bi-weekly petroleum products prices

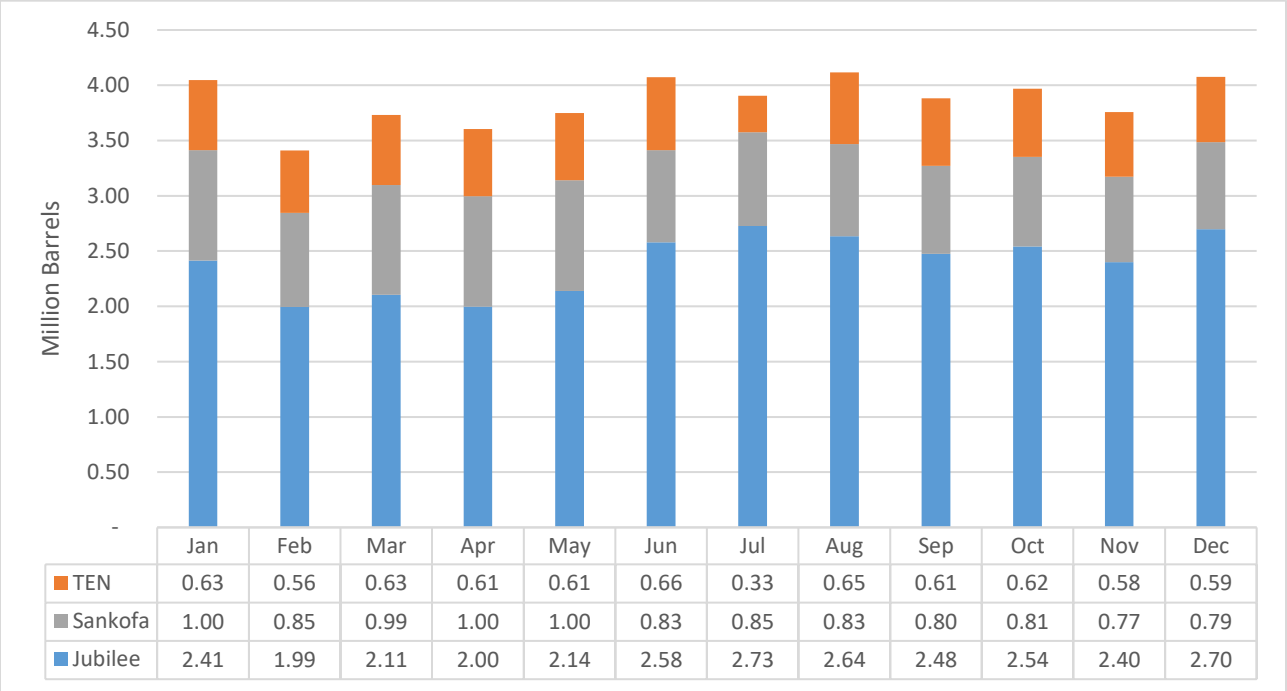
Source: NPA

Chapter Five: Petroleum Outlook 2023

5.1 Outlook for Crude Oil

5.1.1 Crude Oil Production

Total crude oil production in Ghana has witnessed a downward trend, since the advent of COVID-19 in 2020, and is expected to continue in 2023. Production is projected to be 46.32 million barrels, a 10.5% decline from 2022 production. The expected reduction is due to the anticipated reduction in production from all three oil-producing fields. Figure 50 presents the expected monthly volumes of crude oil production from the three fields in 2023.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEN	0.63	0.56	0.63	0.61	0.61	0.66	0.33	0.65	0.61	0.62	0.58	0.59
Sankofa	1.00	0.85	0.99	1.00	1.00	0.83	0.85	0.83	0.80	0.81	0.77	0.79
Jubilee	2.41	1.99	2.11	2.00	2.14	2.58	2.73	2.64	2.48	2.54	2.40	2.70

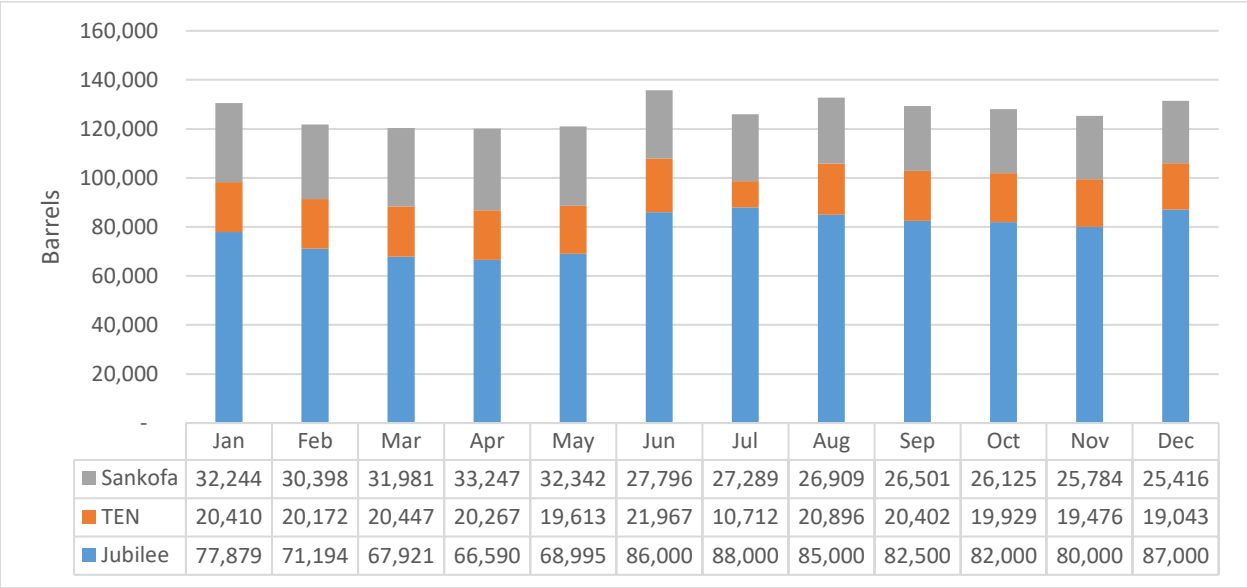
Figure 51: Monthly crude oil production outlook for 2023

Source: GNPC

The Jubilee field is expected to decrease its production from 30.52 million barrels in 2022 to 28.71 million barrels in 2023. Also, production from TEN and Sankofa fields is expected to reduce in 2023.

The TEN field is expected to produce 7.09 million barrels in 2023, a decline from 8.61 million barrels produced in 2022, while Sankofa production is expected to be 10.52 million barrels, down from 12.62 million barrels produced in 2022.

Average daily production from the three fields combined is expected to be low in 2023, averaging 126,870 barrels per day, a decline of 10.6% from 2022 production. Figure 51 presents the expected monthly average daily production of crude oil in 2023.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sankofa	32,244	30,398	31,981	33,247	32,342	27,796	27,289	26,909	26,501	26,125	25,784	25,416
TEN	20,410	20,172	20,447	20,267	19,613	21,967	10,712	20,896	20,402	19,929	19,476	19,043
Jubilee	77,879	71,194	67,921	66,590	68,995	86,000	88,000	85,000	82,500	82,000	80,000	87,000

Figure 52: Projected daily average crude oil production for 2023

Source: GNPC

The average daily production from the Jubilee fields will be 78,590 barrels compared to 83,719 barrels produced in 2022. TEN's average daily production will reduce from 23,597 barrels in 2022 to 19,445 barrels in 2023, while that of Sankofa will also reduce from an average of 34,566 barrels per day in 2022 to 28,836 barrels per day in 2023.

5.1.2 Crude Oil Price

In 2023, the US Energy Information Administration (US EIA) projects the average price of Brent crude oil and WTI crude oil to be US$85.04 and US$79.27 per barrel respectively.

Oil prices may assume a rising trend (Figure 52) due to heightened market concerns about the possibility of oil supply disruptions, notably related to tensions between Russia and Ukraine.

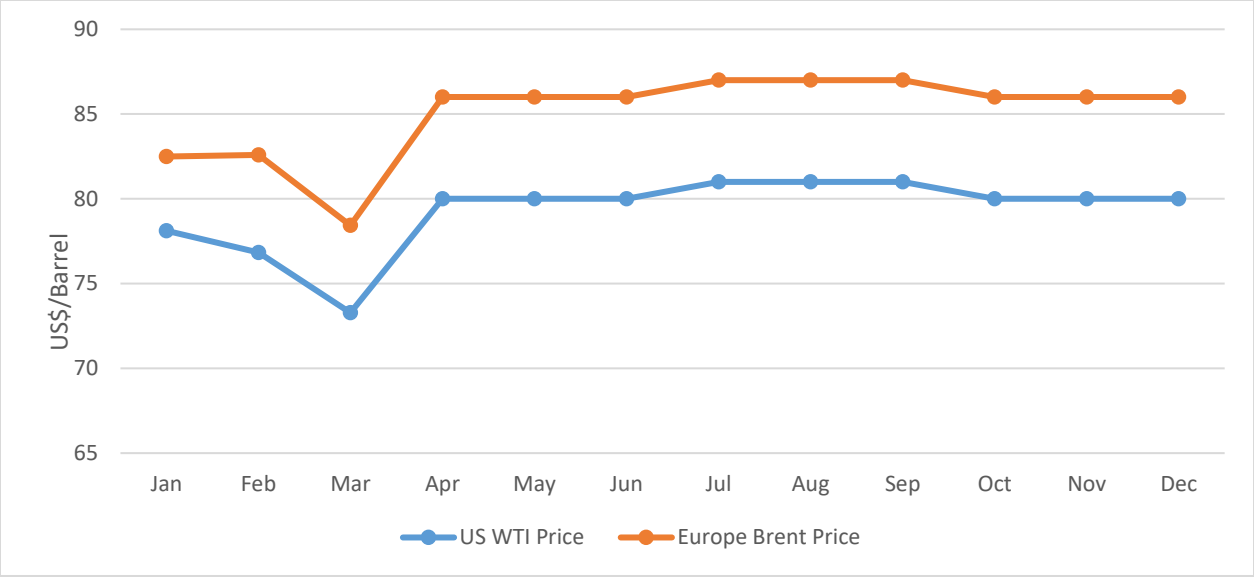


Figure 53: Projected monthly international benchmark crude oil prices for 2023

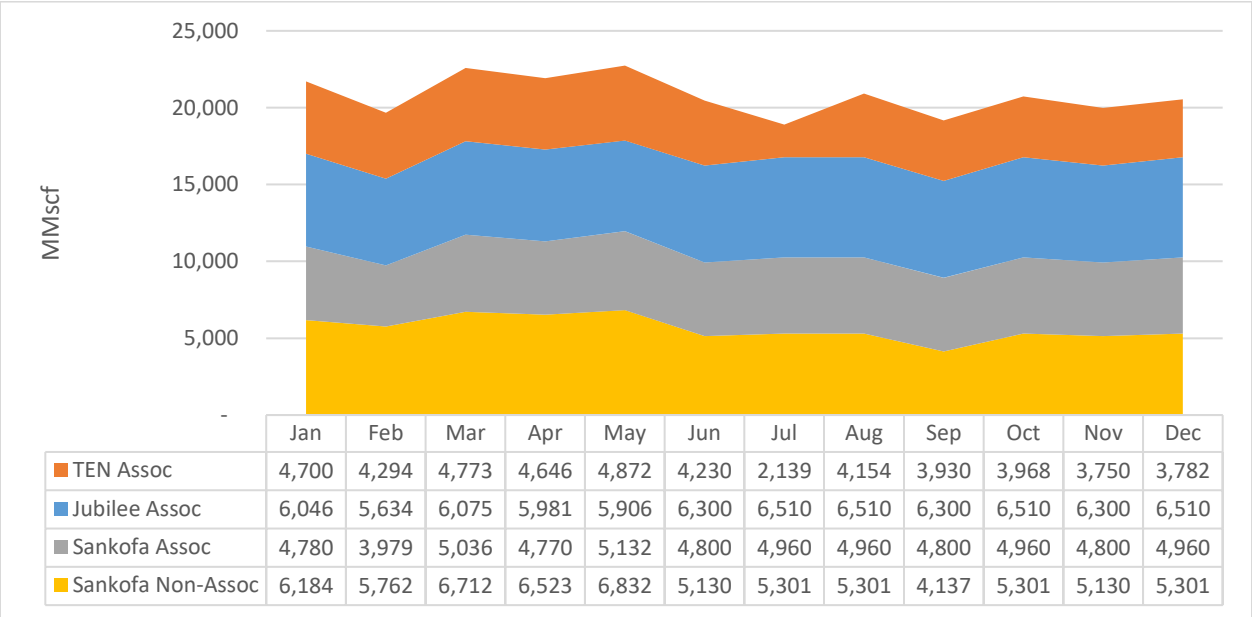
Source: US Energy Information Administration

Ghana's crude oil price will follow the international benchmark price. As such, it is expected that the market price of crude oil from Ghana's fields – Jubilee, TEN and Sankofa will average around US$85.04 per barrel.

5.2 Outlook for Natural Gas

5.2.1 Natural Gas Export Production

In 2023, natural gas production from the three fields is expected to be 249,368 MMscf, representing a 1.7% decrease over the volume of 253,555 MMscf produced in 2022.

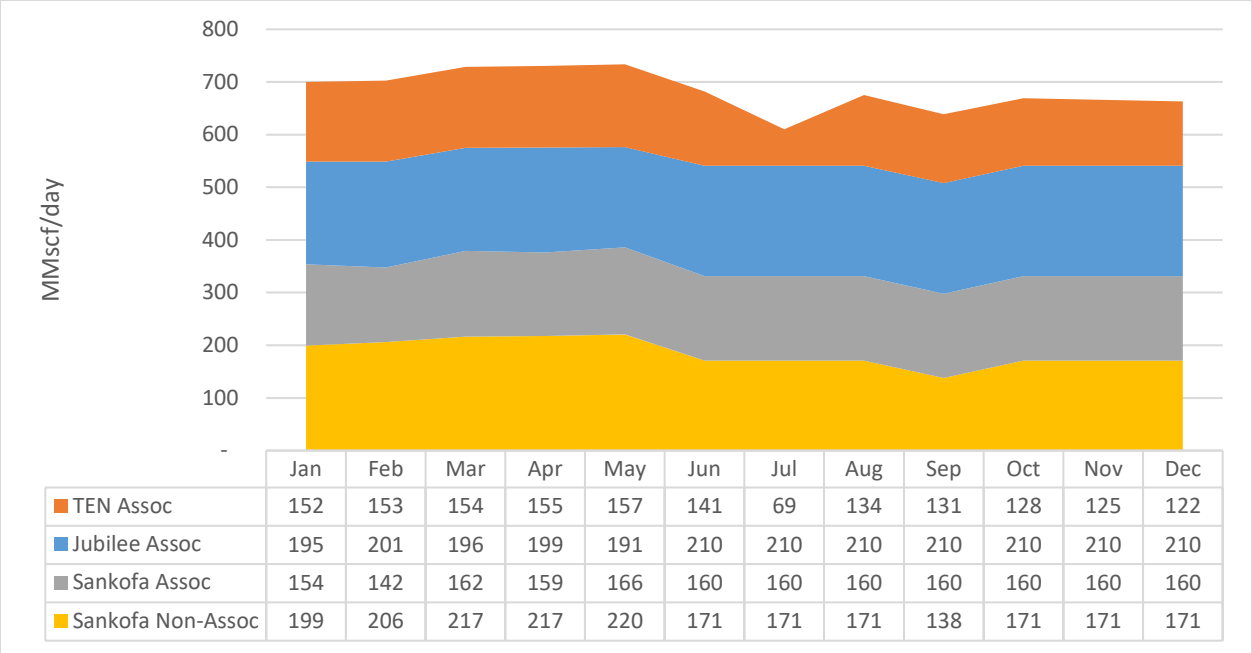


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEN Assoc	4,700	4,294	4,773	4,646	4,872	4,230	2,139	4,154	3,930	3,968	3,750	3,782
Jubilee Assoc	6,046	5,634	6,075	5,981	5,906	6,300	6,510	6,510	6,300	6,510	6,300	6,510
Sankofa Assoc	4,780	3,979	5,036	4,770	5,132	4,800	4,960	4,960	4,800	4,960	4,800	4,960
Sankofa Non-Assoc	6,184	5,762	6,712	6,523	6,832	5,130	5,301	5,301	4,137	5,301	5,130	5,301

Figure 54: Expected natural gas production for 2023

The Jubilee field is expected to increase its production of gas from 68,482 MMscf in 2022 to 74,582 MMscf in 2023. However, production from TEN and Sankofa fields are expected to reduce in 2023. The TEN field is expected to produce 49,237 MMscf in 2023, a decline from 55,679 MMscf produced in 2022, while Sankofa production from associated and non-associated sources are expected to be 57,936 MMscf and 67,613 MMscf respectively. The production from Sankofa associated and non-associated will decline by 0.5% and 5.0% respectively.

Daily production from the three fields combined is expected to be low in 2023, averaging 683 MMscf/day, a decline of 1.6% from 2022 production. Figure 51 presents the expected monthly average daily production of gas in 2023.



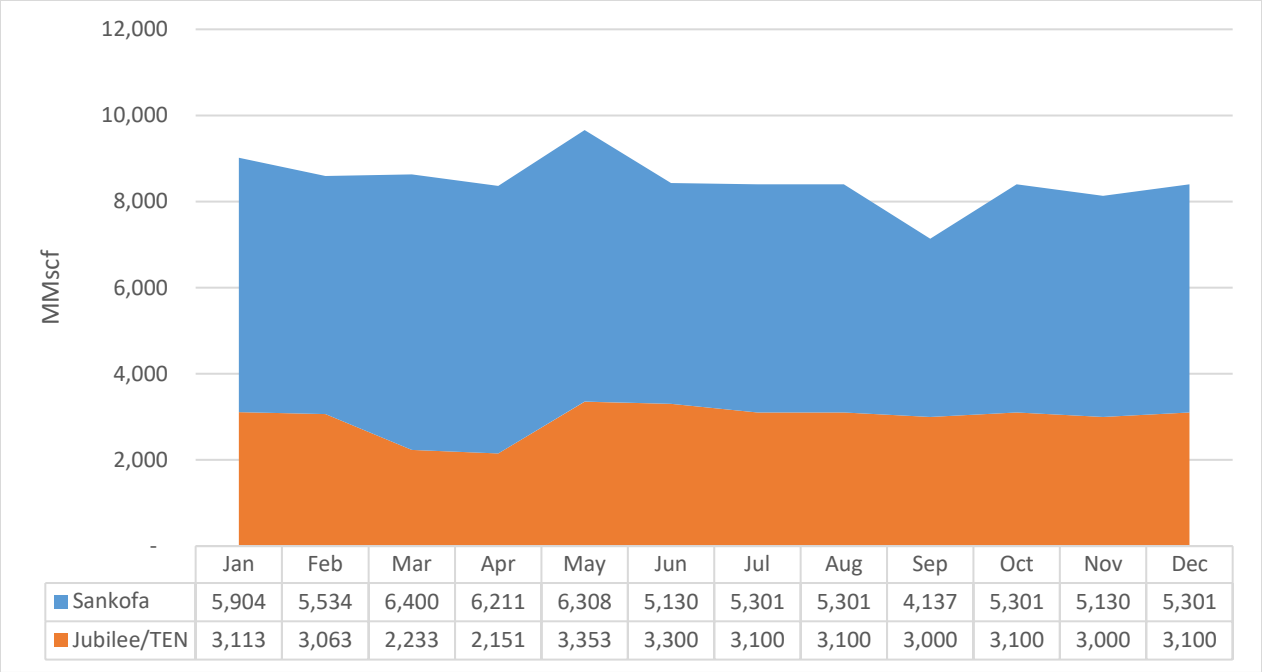
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEN Assoc	152	153	154	155	157	141	69	134	131	128	125	122
Jubilee Assoc	195	201	196	199	191	210	210	210	210	210	210	210
Sankofa Assoc	154	142	162	159	166	160	160	160	160	160	160	160
Sankofa Non-Assoc	199	206	217	217	220	171	171	171	138	171	171	171

Figure 55: Projected daily average gas production for 2023

The average daily production of gas from the Jubilee fields will be 204 MMscf compared to 188 MMscf produced in 2022. TEN's average daily production will reduce from 153 MMscf in 2022 to 135 MMscf in 2022 while that of Sankofa associated and non-associated will be 159 MMscf and 185 MMscf.

5.2.2 Natural Gas Export from Production Fields

In 2023, raw gas export from Jubilee/TEN (associated) to the AGPP is expected to decrease by 10.2% to 35,613 MMscf. Sankofa (non-associated gas) export to the ENI ORF will go down slightly by 2.9% to 65,958 MMscf in 2023. In all, a total of 101,571 MMscf of associated and non-associated gas will be exported in 2023, a decrease of 5.6% over the 2022 export (Figure 53). Sankofa is expected to maintain its capacity to supply up to 207 MMscf/day, while Jubilee and TEN together are expected to supply 110 MMscf/day.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sankofa	5,904	5,534	6,400	6,211	6,308	5,130	5,301	5,301	4,137	5,301	5,130	5,301
Jubilee/TEN	3,113	3,063	2,233	2,151	3,353	3,300	3,100	3,100	3,000	3,100	3,000	3,100

Figure 56: Expected natural gas export from production fields in 2023

Source: GNPC

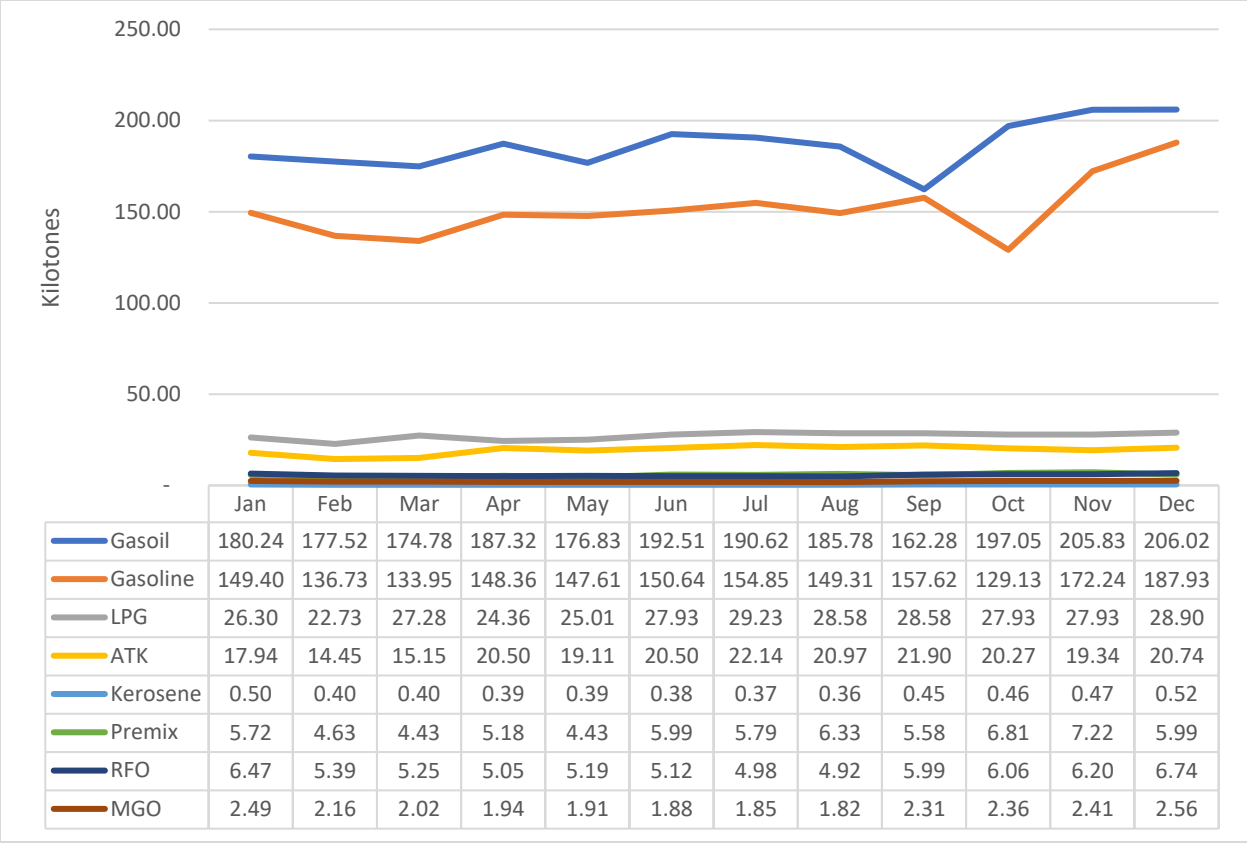
5.2.3 Natural Gas Import

Natural gas import from Nigeria is expected to be about 60 MMscf/day. The Tema LNG facility was expected to receive its maiden import of LNG in 2022, but this has been postponed. Thus, no LNG imports are expected in 2023.

5.3 Outlook for Petroleum Products

5.3.1 Petroleum Products Demand

Total petroleum products consumption in 2023 is projected to be 4,778.5 kilotonnes, an increase of 13.4% over 2022 consumption (Figure 54). The expected increase in consumption is attributed to the anticipated recovery of the economy leading to higher consumption of petroleum products.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gasoil	180.24	177.52	174.78	187.32	176.83	192.51	190.62	185.78	162.28	197.05	205.83	206.02
Gasoline	149.40	136.73	133.95	148.36	147.61	150.64	154.85	149.31	157.62	129.13	172.24	187.93
LPG	26.30	22.73	27.28	24.36	25.01	27.93	29.23	28.58	28.58	27.93	27.93	28.90
ATK	17.94	14.45	15.15	20.50	19.11	20.50	22.14	20.97	21.90	20.27	19.34	20.74
Kerosene	0.50	0.40	0.40	0.39	0.39	0.38	0.37	0.36	0.45	0.46	0.47	0.52
Premix	5.72	4.63	4.43	5.18	4.43	5.99	5.79	6.33	5.58	6.81	7.22	5.99
RFO	6.47	5.39	5.25	5.05	5.19	5.12	4.98	4.92	5.99	6.06	6.20	6.74
MGO	2.49	2.16	2.02	1.94	1.91	1.88	1.85	1.82	2.31	2.36	2.41	2.56

Figure 57: Monthly outlook for petroleum product consumption

Source: NPA

Gasoil and gasoline consumption is projected to be about 2,236.8 kilotonnes and 1,817.8 kilotonnes respectively in 2023. This will represent an increase of about 12.3% and 14.0% over the 2022 consumption of gasoil and gasoline respectively. LPG and ATK consumptions are also expected to increase by 6.5% and 11.2% respectively in 2023 over consumption in 2022. Consumption of other petroleum products such as Premix and RFO is expected to increase to 68.1 kilotonnes and 67.4 kilotonnes respectively.

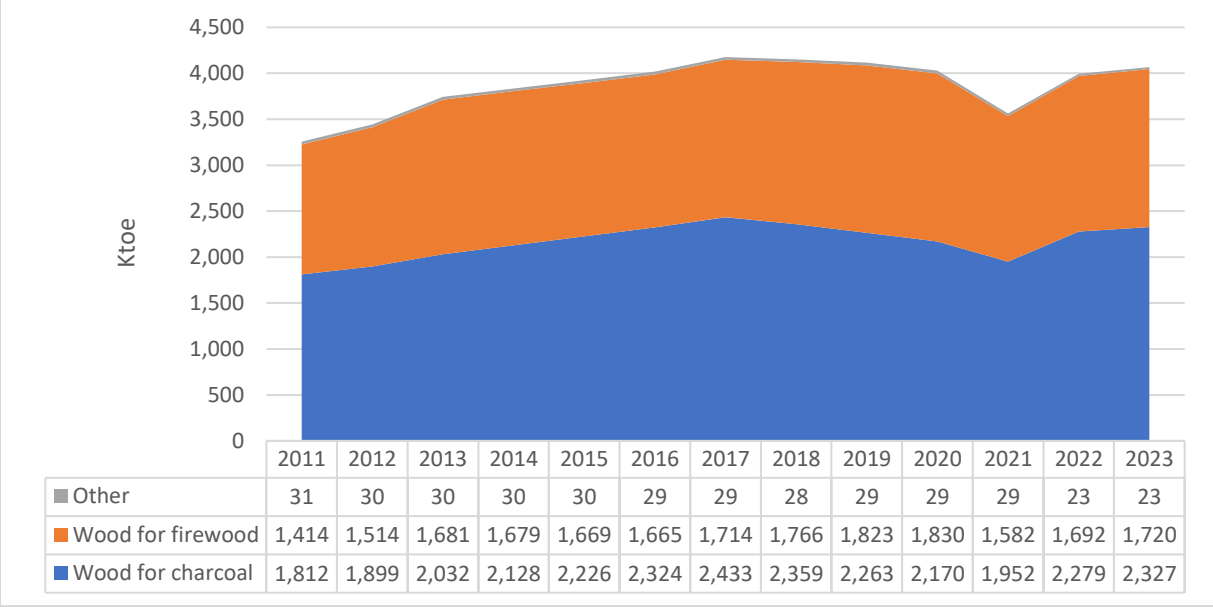
Chapter Six: Woodfuel Sub-sector

Despite efforts to encourage the substitution of woodfuel with LPG, many Ghanaian households continue to rely on woodfuel for cooking and heating. The woodfuel sub-sector also supports a variety of businesses, including bread-baking, oil-palm processing, local breweries, the traditional textiles industry, traditional soap manufacturing, fish smoking, and local catering services. The continued reliance on woodfuel may be attributed to a variety of factors, including relatively easy accessibility and reduced price when compared to LPG.

6.1 Woodfuel Production and Consumption

6.1.1 Woodfuel Production

The total wood fuel produced for all purposes (mainly charcoal and firewood production) increased from 3,256 Ktoe in 2011 to 3,994 Ktoe in 2022, at an average annual growth rate of 1.9%. In 2023, production is expected to reach 4,070 Ktoe in 2023 (Figure 55).



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Other	31	30	30	30	30	29	29	28	29	29	29	23	23
Wood for firewood	1,414	1,514	1,681	1,679	1,669	1,665	1,714	1,766	1,823	1,830	1,582	1,692	1,720
Wood for charcoal	1,812	1,899	2,032	2,128	2,226	2,324	2,433	2,359	2,263	2,170	1,952	2,279	2,327

Figure 58: Woodfuel production[10]

[10] 2023 National Energy Statistics: http://energycom.gov.gh/files/2020%20ENERGY%20STATISTICS-revised.pdf

Charcoal Production

The majority of the wood used as fuel in the various economic sectors is consumed as charcoal for cooking and in other small-scale industries. Wood for charcoal production was 1,812 Ktoe in 2011 which has increased by 2.1% annually to 2,279 Ktoe in 2022. As observed in Figure 58, production in 2022 increase by 16.8% from the 2021 production and this could be attributed to increase demand for charcoal. With the continue increase in demand for charcoal, it is anticipated that charcoal production will increase further by 2.1% to reach 2,327 Ktoe in 2023.

Firewood production

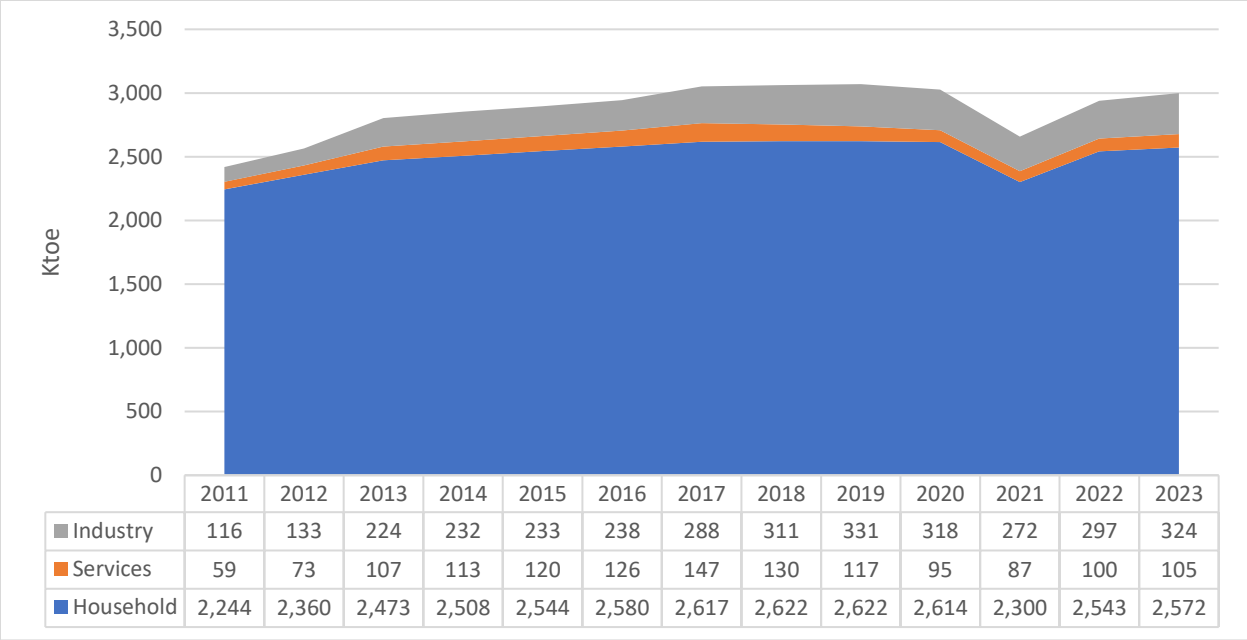
In 2011, the total estimated firewood production was 1,414 Ktoe and increased to 1,692 Ktoe in 2022 at an annual growth rate of 1.6%. The 2022 firewood production increased by 7.0% from 1,582 Ktoe in 2021. This value for 2022 is anticipated to increase by about 1.6% to reach 1,720 Ktoe in 2023.

Other Biomass production

The production of other biomass (mainly crop residue) was about 23 Ktoe in 2022, and it's expected to remain around this quantity in 2023.

6.1.2 Biomass Consumption

The total biomass consumed in the economy was 2,940 Ktoe in 2022, up by 1.8% from 2021 consumption and expected to increase to 3,000 Ktoe in 2023. The residential sector is the largest consumer of biomass with a share of 86.5%, followed by the industrial sector with a share of 10.1% and the least biomass sector consumer is 3.4% which is the service sector (Figure 56).



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Industry	116	133	224	232	233	238	288	311	331	318	272	297	324
Services	59	73	107	113	120	126	147	130	117	95	87	100	105
Household	2,244	2,360	2,473	2,508	2,544	2,580	2,617	2,622	2,622	2,614	2,300	2,543	2,572

Figure 59: Biomass consumption by sectors[11]

Residential Sector

This sector has always been the highest consumer of biomass, consuming on average 2,502 Ktoe between 2011 and 2022. The annual growth rate of biomass consumed within this period was 1.1%. Biomass consumption is further expected to increase by 29 Ktoe to reach 2,572 Ktoe in 2023.

Industrial Sector

This sector has the fastest growing rate of 8.9% per annum. In 2011, the consumption by the industrial sector was 116 Ktoe and rose to 297 Ktoe in 2022 and it is further expected to increase to 324 Ktoe in 2023.

Service Sector

[11] 2023 National Energy Statistics: http://energycom.gov.gh/files/2020%20ENERGY%20STATISTICS-revised.pdf

Biomass consumption by the service sector is the least among the major sectors of the economy. The average annual consumption was 106 Ktoe from 2011 through to 2022 at an annual growth rate of 4.9%. The service sector's consumption in 2023 is estimated at 105 Ktoe.

6.2 Charcoal Price

Charcoal is bagged and traded in maxi and mini bags. The national average price for a maxi bag of charcoal in 2022 was GH₵59.78, whilst that of a mini bag was GH₵45.74. The average price of charcoal in major market centres across the country in 2022 is shown in Figure 57.

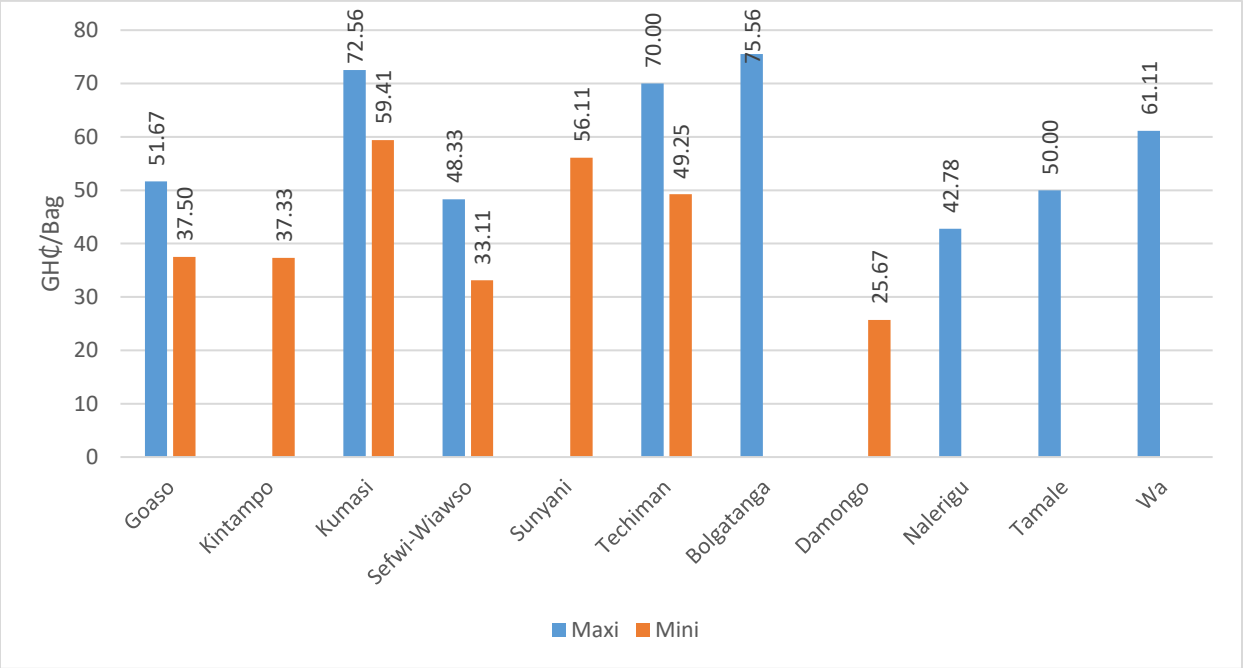


Figure 60: Charcoal price per bag at major market centres across the country

Source: Survey data

Charcoal is priced by volume at the expense of weight, and for that matter, price estimations are calculated per kilogram. The average unit price of charcoal (cedi/kg) in 2022 is estimated and presented in Figure 58.

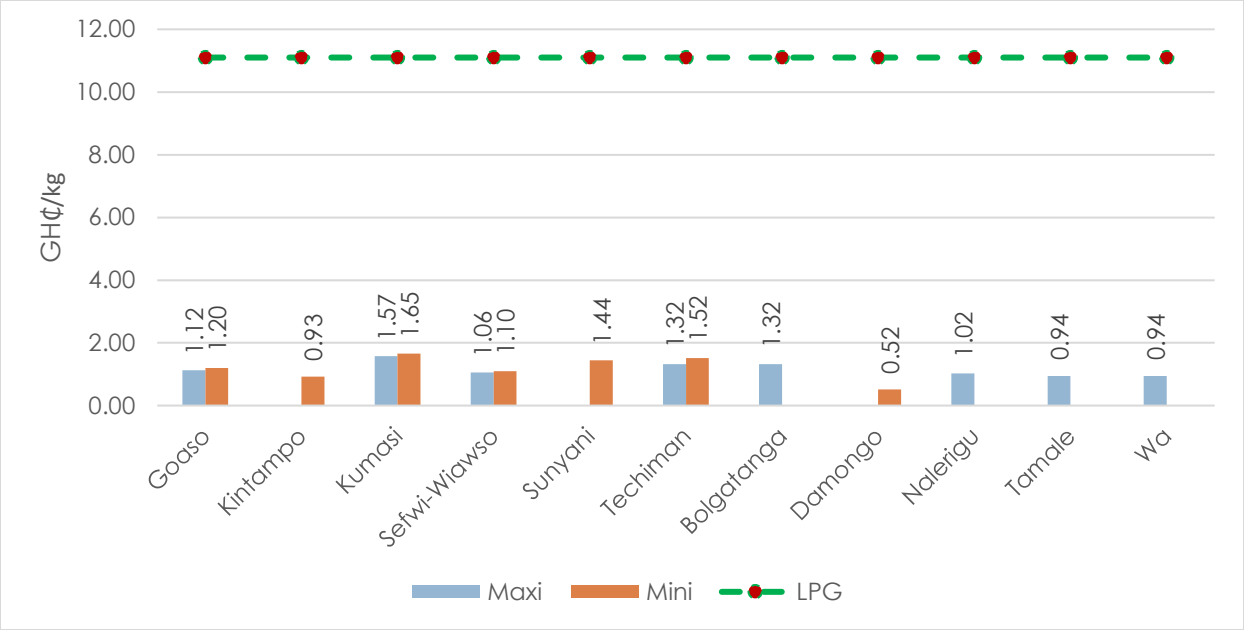


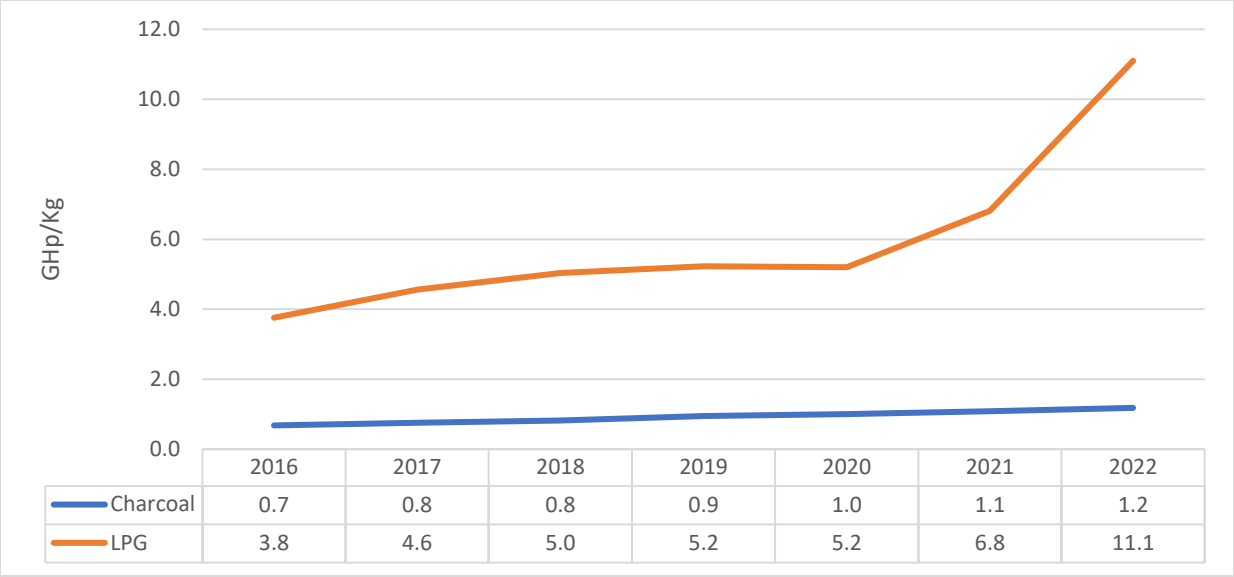
Figure 61: Average price per bag of charcoal across major market centres in Ghana in 2022

Source: Survey data

The national average price per kilogram of charcoal is GH₵ 1.18. The highest price per kg of charcoal was recorded in Kumasi (GH₵1.61) followed by Sunyani and Techiman respectively. Damongo had the least price per kg of charcoal of GH₵ 0.52 followed by kintampo (GH₵ 0.93) and then Wa (GH₵0.94).

A number of factors influence the variation in the price of charcoal including high/low price of LPG, shortage/availability of LPG and the inconvenience in the use of cookstoves. Also, scarcity of charcoal and availability of large supplies of charcoal influence the prices of charcoal. One of the causes of the slow growth in the use of LPG by households as the main cooking fuel is the

price as compared to charcoal. Figure 62 compares the unit price of charcoal and LPG over the last few years.



	2016	2017	2018	2019	2020	2021	2022
Charcoal	0.7	0.8	0.8	0.9	1.0	1.1	1.2
LPG	3.8	4.6	5.0	5.2	5.2	6.8	11.1

Figure 62: Price per kg of LPG and Charcoal

Source: Survey data

The price of LPG per kg has seen a drastic climb in 2022, whilst the price of charcoal per kg has only witnessed a modest increase over the period (Figure 50). This implies that the price of charcoal tends to be stable compared to LPG. In 2023, charcoal price is expected to increase, but marginally. At worst charcoal prices would grow at the same rate as the national inflation rate for the year.

Chapter Seven: Conclusions and Recommendations

7.1 Conclusions

7.1.1 Electricity

The system peak demand in 2023 is projected to increase by 5.9% to 3,673 MW. The corresponding projected energy consumption for 2023 is projected to be 23,617 GWh, an increase of 5.1% over 2022 consumption. Domestic consumption (including VALCO and losses) will constitute 90.1% of total consumption, while energy export will constitute 9.9% of total consumption. VALCO is expected to operate on two potlines in 2023.

To meet anticipated demand, hydro and thermal plants are projected to generate 8,025 GWh (34.1%) and 15,244 GWh (64.7%) respectively. The remaining energy of 297 GWh, representing 1.3%, is expected to be met by the embedded generation mostly renewables.

Power generation capacity of 5,527.1 MW with a total dependable capacity of 4,979.3 MW will be available for electricity generation in 2023. However, considering the planned units' maintenance and fuel supply situation, it is anticipated that up to 4,119 MW of the total dependable capacity (capacity contributing to peak demand) will be made available to meet the expected system peak demand of 3,673 MW with a reserve margin of 12% - less than the minimum reserve margin of 18%.

Fuel for thermal power plants in 2023 will be mainly natural gas from indigenous and import sources. Total natural gas consumption for the year is projected to be 128.5 TBtu. An estimated 382,619 barrels of HFO will be required by the AKSA plant in 2023. The total cost of fuel is estimated to be $872.83 million in 2023. About $817.80 million will be used to procure natural gas and the remainder for the procurement of HFO to fuel the AKSA plant.

7.1.2 Petroleum

In 2023, total crude oil production is expected to decline further to 46.32 million barrels due to an anticipated reduction in production from all three oil-producing fields. The Jubilee field is expected to decrease its production to 28.71 million barrels while TEN and Sankofa fields are expected to reduce their production to 7.09 million barrels and 10.52 million barrels, respectively. The average daily production from the three fields is expected to be 126,870 barrels. The Jubilee fields will contribute the highest of 78,790 barrels/day, while the TEN and Sankofa fields are each expected to contribute 19,445 barrels/day and 28,836 barrels/day, respectively.

Crude oil price is expected to stable between April and December 2023. The US EIA put Brent crude oil prices at an average of US$85.04 per barrel in 2023. It is expected that the average achieved price of Ghana's crude oil from the three fields – Jubilee, TEN and Sankofa will hover around the international benchmark price.

Natural gas production from the three fields is expected to be 249,368 MMscf in 2023, representing a 1.7% decrease from 2022. Average daily production from the three fields together would be slightly low in 2023, averaging 683 MMscf. Jubilee field is expected to increase its production of gas from 68,482 MMscf in 2022 to 74,582 MMscf in 2023. The TEN field is expected to produce 49,237 MMscf in 2023, a decline of 11.6% from production in 2022. Sankofa field production from associated and non-associated sources is expected to decline by 0.5% and 5.0% from 2022 production, reaching 57,936 MMscf and 67,613 MMscf respectively.

Raw gas export from Jubilee/TEN (associated) to the AGPP is expected to decrease to 35,613 MMscf. Sankofa (non-associated gas) export to the ENI ORF will go down slightly to 65,959 MMscf in 2023. Thus, a total of 101,571 MMscf of associated and non-associated gas will be exported to the AGPP and ENI ORF in 2023. On a daily basis, Sankofa is expected to maintain its capacity to supply up to 207 MMscf/day to the ORF in 2023 while Jubilee and TEN together are expected to supply up to 110 MMscf/day to the AGPP. The expected import from Nigeria is pegged at 60 MMscf/day.

Total petroleum products consumption in 2023 is projected to be 4,778.5 kilotonnes, an increase of 13.4% over 2022 consumption. Out of this, gasoil consumption is forecast to be about 2,236.8 kilotonnes, while gasoline will be 1,817.8 kilotonnes. This will represent an increase of about 12.3% and 14.0% over the 2022 consumption of gasoil and gasoline respectively. LPG consumption is expected to grow by 6.5% from 305 kilotonnes in 2022 to about 324.7 kilotonnes in 2023. ATK and kerosene consumption for 2023 are expected to be 233.0 kilotonnes and 5.1 kilotonnes, respectively. Other petroleum products such as Premix and RFO are expected to increase their consumption to 68.1 kilotonnes and 67.4 kilotonnes respectively.

7.1.3 Woodfuel

In 2023, wood to be extracted for use as firewood is estimated to be 1,720 Ktoe, an increase of 1.6.0% from 2022. Wood to be extracted for charcoal production would be 2,327 Ktoe, in 2023, increasing by 2.1% from 2022. The production of other biomass (mainly crop residue) would be about 23 Ktoe in 2023.

The residential sector will continue to be the biggest consumer of biomass. Household consumption of biomass is expected to rise to 2,572 Ktoe in 2023, while the services and industrial sectors are each expected to consume 105 Ktoe and 324 Ktoe, respectively.

The national mean price for a maxi bag of charcoal in 2022 was GH¢59.78, while the mean price for a mini bag of charcoal was GH¢45.74. For 2023 charcoal price is expected to grow at the same rate as the national inflation rate for the country.

7.2 Recommendations

The following recommendations are made.

7.2.1 Electricity

1. Projected hydro generation levels are to be adhered to in order to keep fuel costs at projected levels and also to reduce the likelihood of spilling at Akosombo GS.

2. Security and adequacy of fuel supply to thermal plants remain the single most important risk to power supply reliability in the country. In this regard, it is strongly recommended that all stakeholders work together to ensure that the fuel supply is adequate and secure at all times.

3. Quantities of liquid fuels (LCO, HFO and Diesel) therefore need to be procured and stored for use at the respective dual-fired thermal power plants in case of instances of gas supply interruption.

4. Due to the growing electricity demand, there is a need to make arrangements to increase gas supply volumes to enable more thermal generation to avoid excessive drawdown on Akosombo and Bui hydro facilities.

5. Government should make necessary investments towards improved gas supply reliability owing to the increasing dependency on natural gas for power generation.

6. With electricity generation largely dependent on thermal plants, any prolonged disruptions in gas supply may burden the country's situation in terms of generation costs since the gas price is, on average, lower than liquid fuels.

7. The government should expedite the creation of a generation enclave in Kumasi for network stability. This will help address voltage limit violations in the mid-sections of the power system in situations where Bui units are not in service and to reduce line loadings between Kumasi and Tema Enclave as well as Kumasi and Takoradi Enclave. This will boost supply reliability to bulk customers such as the mines in the West and also give Ghana a competitive advantage for power export to Burkina, Mali and other potential customers north of Ghana.

7.2.2 Petroleum

1. Set up a strategic stock for crude oil (which can be refined when the need arises) to ensure fuel supply security in the country.
2. The government should expand crude oil refinery capacity and make existing ones fully functional (i.e., resourcing TOR to procure crude oil) to reduce dependence on imported finished petroleum products.
3. The government is targeting 50% LPG penetration in households by 2030, but the achievement of this target might be a challenge if limited distribution outlets nationwide remain the same and LPG prices continue to remain high. In this light, the government needs to consider investment incentives to encourage OMCs and other interested investors to set up more LPG storage and distribution outlets nationwide to increase access and affordability. Also, the government should expedite the rollout of the cylinder recirculation model to help increase access.

7.2.3 Woodfuel

1. Biomass consumption has been estimated to be increasing over the last decade. It is recommended that government intensify measures that will increase LPG penetration, especially in rural areas, to reverse the increasing demand for woody biomass.
2. A comparison of charcoal and LPG prices per MMBtu revealed that it costs more to get a unit of useful energy from LPG than from charcoal, regardless of stove efficiency. To encourage and increase LPG use (which is more efficient and environmentally friendly), the Ministry of Energy, through relevant stakeholders such as NPA, take necessary steps to reduce the price of LPG. The price intervention will also help realise the government's policy of achieving 50% of households using LPG by 2030.


ENERGY COMMISSION